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*Meyer, E., and Arnold, L., *Amer. J. Digest. Dis.*, 5:418.

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COMBINED NECK AND MOUTH DISSECTION FOR ORAL CARCINOMA

By Howard H. Eddey

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A GENERALLY accepted method of treatment of oral carcinoma is to control the primary tumour by surgery, by radiotherapy or by both and to perform a radical neck dissection if and when cervical metastases develop. That this treatment is often adequate depends primarily on the embolic nature of the spread of cancer cells from the primary tumour to the lymph nodes.

Spread by permeation of tumour cells along lymphatics is uncommon and therefore failure to treat the intermediate area between the primary tumour and the nearest lymph nodes usually does not influence the prognosis. It is not common to find carcinoma developing in this area after adequate treatment of the primary and after radical neck dissection for cervical node metastases. If carcinoma does recur in this area, it is extremely difficult to eradicate and in most cases is incurable despite the most strenuous efforts, either by radiotherapy or by surgery or by both.

Case Report

In 1951 Mr. J.M., then aged 52 years, developed an epithelioma on the right side of his tongue. The tumour occurred on the lateral border of the anterior one-third of the tongue and it measured 2.5 cm. by 2.5 cm. by 1.0 cm. in extent. No enlarged lymph nodes were present and the tumour rapidly regressed following a radon implant.

Six months later a right radical neck dissection was performed because of the development of an enlarged submandibular lymph node. However, pathological examination of the tissue excised showed an absence of metastases in all lymph nodes. The patient recovered rapidly from this operation and his prognosis was regarded as excellent.

He was next treated in April, 1954, when a hard swelling 4 cm. by 2.5 cm. was felt in the floor of the mouth on the right side in the untreated area between the tongue and the lymph field in the neck. This lump had been present for six months and although it was not tender the patient suffered from pain which radiated along the second and third divisions of the fifth cranial nerve. The lump was fixed to the inner aspect of the mandible and it involved the previously dissected submandibular region.

This recurrence was operated upon and excised together with portion of the mandible, the adjacent floor of the mouth and of the tongue, so that an adequate amount of uninvolved tissue surrounding the recurrence was removed. Examination of the excised tissue confirmed the presence of squamous epithelioma in the tissues of the floor of the mouth around the mandible. The bone itself was not involved.

By August, 1954, another hard lump had developed in the upper part of the neck posterior to the area removed four months previously. This lump was 3 cm. in diameter and it represented another local recurrence.

Further diathermy excision of the area was carried out and examination of the removed tissue confirmed the presence of squamous epithelioma.

In December, 1954, the patient was re-admitted because a hard mass had developed on the left side of his neck at the middle of the anterior border of the sternomastoid muscle. A left radical neck dissection was performed and examination of the removed tissue revealed extension of squamous epithelioma to the tissues of the neck. The tumour involved fibrous tissue and muscle in the neck, but did not involve any lymph nodes.

In May, 1955, the patient was re-admitted because of severe pain on the right side of his face and upper neck. This pain was dealt with by operation (Mr. R. S. Hooper) and the right glossopharyngeal and trigeminal nerves and also the posterior roots of the upper four cervical nerves were divided. Because of marked oedema of the vocal cords at this operation a tracheostomy was performed, but the patient developed pneumonia and lung abscesses from which he died shortly afterwards.

This case history illustrates the great difficulty in dealing with recurrence of epithelioma in the untreated area between the site of the primary in the tongue and the lymph field in the neck. Once this recurrence occurs nothing short of extensive radical surgery can be contemplated.

It is not suggested that all patients suffering from oral carcinomata should undergo a combined radical neck and mouth dissection, with or without preliminary radiotherapy, but there are several circumstances in which this treatment is mandatory. The indications for a combined dissection are as follows:—

1. When a carcinoma spreads from the tongue or the floor of the mouth to involve the mandible.
2. When a tumour infiltrates through the mylohyoid muscle into the submandibular region.
3. When a tumour in the oral cavity recurs following radiotherapy.
4. When a tumour arises in the mandible itself.
5. When a deeply infiltrating tumour of the tongue or floor of the mouth with cervical metastases is present when the patient first presents for treatment.

Treatment of an intra-alveolar carcinoma or a fibrosarcoma of the mandible is entirely a surgical problem but whether an epithelioma of the oral cavity infiltrating into the mandible or into the submandibular region is given a preliminary course of radiotherapy or not depends on several circumstances, not the least of which is the liaison which may or may not exist between radio-therapeutist and surgeon. The writer has been fortunate in having the collaboration of Dr. R. Kaye Scott in treating most of these patients and it has been the practice to eradicate the soft tissue portion of the tumour in the oral cavity by preliminary radiotherapy and then to perform a combined mouth and neck dissection six weeks later. This preliminary treatment ensures that all submucosal spread beyond the obvious macroscopic extent of the tumour in the mouth will be controlled before surgery is undertaken.

A combined neck and oral dissection involves either removal of portion of the mandible (when the tumour invades the mandible or arises in the mandible) or splitting the symphysis menti to obtain exposure of the oral cavity (when the carcinoma infiltrates deeply into the floor of the mouth or when it has recurred after radiotherapy).

Experience in the surgery of mouth and neck cancer has been gained by the performance of 72 radical neck dissections in 63 patients. In 41 patients this operation has been part of the treatment of squamous epithelioma involving the oral cavity (24), lower lip (13), upper lip (2) and larynx (2) and the results of treatment of this group will be discussed in a further communication. In 7 of the 24 patients with squamous epithelioma of the oral cavity the operation has been a combined neck and mouth dissection involving either removal of portion of the mandible involved by tumour or splitting the mandible for access. Two patients, in addition to the above 63, have had removal of a portion of the mandible with a limited upper neck dissection in continuity.

Eight patients have had a radical neck dissection for a squamous epithelioma of the skin of the face or neck previously treated by radiotherapy. Nine patients have had a radical neck dissection for a malignant melanoma of the face or scalp and 5 for a malignant salivary gland tumour.

Neck dissection for mouth, lip and face epithelioma has been undertaken when clinical evidence of metastases to the cervical lymph nodes is apparent and, in 80 per cent. of operations, the clinical diagnosis has been confirmed by histological examination of the excised nodes. In only two cases of malignant melanoma and one of malignant salivary gland tumour has clinical evidence of metastases been present before operation.

The technique of radical neck dissection has been described previously (Eddey, 1954) and the purpose of this paper is to indicate the technique of combined neck and mouth dissection.

The operation can conveniently be divided into eight stages.

1. Pre-operative management.
2. Neck dissection.
3. Entry into the oral cavity.
4. Oral dissection.
5. Dissection of the mastoid-mandibular fossa.
6. Wound closure.

7. Post-operative management.
8. Jaw reconstruction.

PRE-OPERATIVE MANAGEMENT

The operation is an extensive one and is normally performed in elderly patients. All patients must be assessed as to their ability to withstand the rather prolonged operative procedure and any necessary treatment to the cardiovascular and respiratory systems instituted. In particular, a short course of physiotherapy to obtain correct lung aeration is essential. Anaemia if present is corrected by blood transfusion and dehydration by saline infusions. A saline transfusion is maintained during operation so that any necessary intravenous therapy can be given rapidly at any stage.

Since feeding may be a problem in the first two or three post-operative days, a Ryle's tube is passed into the stomach through the nose before operation.

Anaesthesia consists of pentothal followed by gas administered through a cuffed endotracheal tube. This tube is passed through the nasal cavity if possible, but passage through the mouth creates little difficulty in the operation and this method is commonly used. Packing gauze is inserted around the tube just before it enters the upper aperture of the larynx, so that blood does not trickle into the larynx during operation. The question of hypotensive anaesthesia is an important one as there is no doubt that this form of anaesthesia greatly diminishes the blood loss. However, this method of anaesthesia is not without danger and as other methods are available to diminish blood loss the anaesthetist has rarely been asked for this technique.

Blood loss is not great provided that the head and shoulders of the patient are elevated by adjusting the operation table and a solution of adrenalin hydrochloride (1 in 250,000) is injected under the skin which is to be elevated. By these methods and by the use of diathermy to coagulate vessels as elevation of the skin flaps proceeds, it is possible to make such elevation almost bloodless. This is important as most of the blood loss in the operation may occur during elevation of the skin flaps rather than during the major procedure of neck dissection as during this all vessels are clamped before they are cut.

A sponge rubber pillow is placed under the patient's heels to elevate the calves of the legs from the operation table. This may diminish the likelihood of phlebothrombosis in the calf muscles by removing pressure on these muscles during the prolonged operative procedure which may last for two and one half to three and one half hours.

NECK DISSECTION

The incision commences over the mastoid process and passes forwards below the angle of the jaw to just below the point of the chin on the opposite side. From the midpoint of this collar incision, a vertical incision passes downwards to cross the clavicle just posterior to the clavicular insertion of the sternomastoid muscle. In a combined dissection the skin flaps are elevated with the underlying platysma so that their viability is ensured (Martin *et alii*, 1951). Inclusion of the platysma in the skin flaps is particularly necessary when pre-operative radiotherapy has been given.

The upper skin flap is dissected from the surface of the parotid salivary gland and from the surface of the length of the body of the mandible.

This flap must be lifted upwards to expose the fat of the cheek over the buccinator muscle and to expose the upper aspect of the symphysis menti.

The anterior skin flap is dissected forwards to the midline of the neck as far down as the sterno-clavicular joint. The posterior skin flap is dissected backwards to expose the anterior border of the trapezius muscle as far down as the clavicle.

The sternomastoid and omohyoid muscles, the external and internal jugular veins, the supraclavicular nerves and the fat in the posterior triangle are divided just above the clavicle. Division of the internal jugular vein is accomplished after incision of the carotid sheath to mobilize the common carotid artery and the vagus nerve from the vein. The phrenic nerve is seen lying beneath the deep cervical fascia posterior to the internal jugular vein. The transverse cervical artery is divided as it passes laterally in front of the phrenic nerve and the accessory nerve is divided as it descends beneath the anterior border of the trapezius muscle.

The tissues thus divided and the cervical fascia are dissected upwards from the muscles of the posterior triangle to expose the fifth and sixth cervical nerves passing outwards and downwards to form the upper trunk of the brachial plexus. As the dissection continues upwards in this deep plane, the cutaneous nerves from the cervical plexus (greater auricular, lesser occipital and the cutaneous nerve of the neck) are divided as they appear at the lateral border of the scalenus anterior muscle. The descendens hypoglossi and the descendens cervicalis nerves are also divided, the former as it arises from the second and third cervical nerves and the latter as it arises from the hypoglossal nerve.

The superior belly of the omohyoid muscle is divided anteriorly and the dissection proceeds easily up to the bifurcation of the common carotid artery (Fig. I). Just above this point, the hypoglossal nerve is seen turning forwards across the carotid vessels towards the submandibular region and the nerve is held down by the sternomastoid branch of the occipital artery. It is very convenient to divide the external carotid artery at this stage and to free the hypoglossal nerve by division of the occipital artery. Following this, the nerve can be mobilized upwards and inwards. Such protection of the nerve is only indicated in a procedure which leaves the tongue intact; where a considerable portion of the tongue is to be removed, the nerve itself is sacrificed.

The neck dissection ceases at this stage after division of the submandibular duct, mobilization of the submandibular salivary gland and elevation of the anterior and posterior bellies of the digastric muscle by division of the fascial sling which binds the intermediate tendon to the hyoid bone (Fig. II).

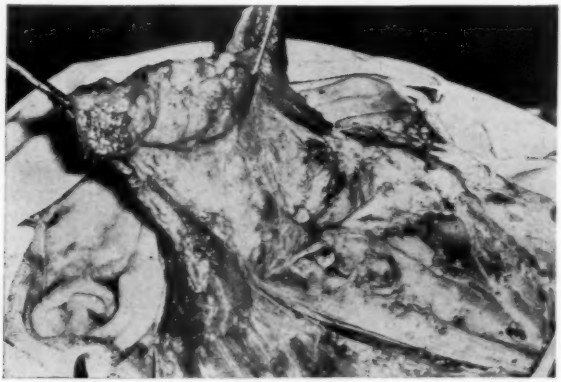

FIG. I. Photograph of the first stage of the operation of combined neck and mouth dissection on the right side showing:—

1. elevation of the sternomastoid muscle, internal and external jugular veins, deep facia and related structures up to the digastric triangle,

2. the common carotid artery passing upwards to its point of bifurcation, the forward direction of the artery indicating the degree of tilt of the operation table and

3. the point of the chin in the middle of the photograph anteriorly and the external ear posteriorly above the dissected tissue.

No further dissection is done in the neck until the mouth cavity is entered.

ENTRY INTO THE ORAL CAVITY

Whether the operation is to remove portion of the mandible or whether the mandible is to be divided to allow access to the oral cavity, the procedure of entry into the cavity is similar.

The upper skin flap has already been dissected from the body of the mandible as far forwards as the symphysis. The anterior belly of the digastric muscle is now detached from the digastric fossa of the mandible and a pair

of forceps passed upwards on the under surface of the bone through the mylohyoid muscle attachment to the upper aspect of the bone in the floor of the mouth.

It is then possible to pass the introducer of a Gigli saw along this track and then to divide the mandible with the saw.

When the division of the bone is merely for the exposure of the oral cavity, such

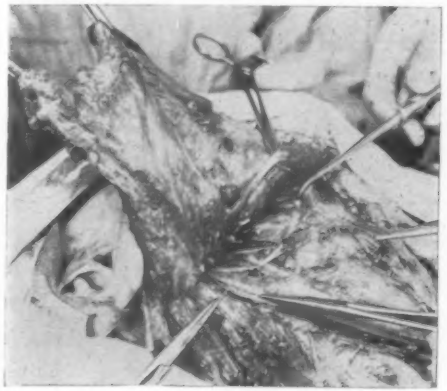

FIG. II. Photograph of the operation after division of the external carotid artery, dissection of the submandibular salivary gland and division of the fascia binding down the intermediate tendon of the digastric muscle showing:—

1. a curved artery forceps beneath the intermediate tendon of the digastric muscle,

2. a single hook retracting the posterior border of the mylohyoid muscle to demonstrate the divided submandibular duct held by a silk ligature attached to a straight artery forceps and

3. the divided external carotid and occipital arteries held by silk ligatures attached to straight artery forceps.
The hypoglossal nerve can be seen passing forwards across the external carotid artery to the digastric triangle.

division is at the symphysis and this procedure may be facilitated by splitting the lower lip in the midline. Before dividing the bone at this point, two holes symmetrical on each side of the midline are drilled through the bone, so that wires can be inserted at the end of the operation to reconstitute the mandible.

When the mandible is divided as part of the treatment necessary for excision of portion of that bone, the point of division is determined by the extent of bone involved by carcinoma. Usually involvement of the bone is such that division can be made between the mental foramen and the symphysis menti. Division at this site does not affect the attachment of the genioglossus muscle to the mandible and therefore the normal attachment of the major portion of the tongue in the midline is not affected. Sometimes, however, the mandible is involved by tumour up to or near the symphysis and when this occurs, division of the mandible must be on the opposite side of the midline and this will remove the normal attachment of the tongue to the mandible.

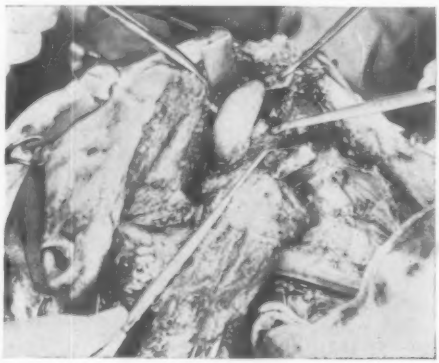

FIG. III. Photograph of the operation after entry into the oral cavity showing:—

1. bone hooks (above and below) separating the two surfaces of the divided mandible.

2. the divided mucosa of the cheek held upwards by a lateral retractor,

3. the tongue and the floor of the mouth indicated by a dissector and

4. the tissue dissected from the neck held posteriorly.

In all cases, however, the point of division of the mandible to obtain entry into the mouth must be anterior to the mental foramen so that the length of mandible in which the alveolar canal lies may be removed. This is important as spread may occur rapidly along the canal if the bone is involved by tumour to this extent. Following division of the mandible anteriorly, the two surfaces of the divided bone may be spread apart to allow entry into the mouth cavity (Fig. III).

ORAL DISSECTION

This phase of the operation is best performed with the cutting diathermy. This, together with the previous ligation of the external carotid artery, greatly lessens the blood loss.

The technique of the oral dissection varies depending on whether the operation is to remove portion of the tongue and floor of

the mouth to eradicate a deeply infiltrating carcinoma or whether the oral procedure is largely necessary because of involvement of the mandible by growth.

When the procedure is for soft tissue removal, the first and essential step is to divide the mylohyoid muscle (and overlying mucosa) at its attachment to the mandible. This frees the tongue and the floor of the mouth from the bone. The diathermy needle is then passed downwards through the tongue from its dorsal surface to the floor of the mouth well clear of the carcinoma, the amount of tongue removed depending on the extent of the growth. The dissection proceeds posteriorly as far as is necessary and is then carried inferiorly towards the submandibular region, so that the tongue and its associated genioglossus, geniohyoid, hyoglossus and mylohyoid muscles are removed. The excised portion of the tongue and the floor of the mouth containing the carcinoma is then in continuity with the tissues which have been elevated by the neck dissection up to the submandibular region and is completely free from the mandible. The lingual and hypoglossal nerves are in the dissected specimen as is the submandibular salivary gland.

Where the oral dissection is designed to remove a carcinoma in the floor of the mouth together with portion of the involved mandible, the procedure is somewhat different. The diathermy needle is used to incise the mucosa of the cheek backwards from the point of division of the mandible to its ramus. The mucosa at the edge of the tongue is then divided well medial to the growth and this incision is carried downwards clear of the growth on the medial side. The dissection continues inferiorly to divide the tongue muscles and to incorporate in the dissected tissue the digastric, hyoglossus and mylohyoid muscles. The incision is then carried backwards well posterior to the growth (if need be into the oro-pharynx) and then through the mucosa covering the inner aspect of the ramus of the mandible above the lingula to divide the medial pterygoid muscle, the inferior dental vessels and nerve and the lingual nerve.

When this has been done, the ramus of the mandible must be exposed laterally. This is achieved by dividing the lower pole of the parotid salivary gland and elevating this gland upwards. At this stage, the cervical and mandibular branches of the facial nerve are divided but elevation of the gland protects the temporo-facial division of the nerve as it crosses the masseter muscle just below the zygomatic process. After the gland has been elevated, the masseter muscle is divided down to the bone at a level just below the mandibular notch.

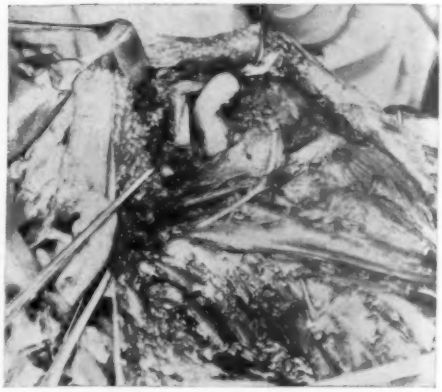

FIG. IV. Photograph of the operation after excision of the right half of the mandible, dissection of the mastoid-mandibular fossa and removal of the dissected neck and mouth tissues showing:—

1. a bone hook holding forwards the divided mandible near the symphysis,
2. the tongue and the divided cheek mucosa,
3. the parotid salivary gland indicated by a probe,
4. the carotid arteries and the vagus nerve and
5. the hypoglossal nerve, turning forwards across the external carotid artery, and the hyoglossus muscle.

The lateral side of the ramus is now cleared and this, together with the previous exposure of the medial side, allows division of the bone by a Gigli saw (Fig. IV). The level of division is always above the lingula and usually just below the mandibular notch. If the degree of involvement of the mandible warrants, the whole of one half of the mandible (or more) can be removed by disarticulating the bone at the temporo-mandibular joint. When the mandible has been divided the dissected specimen of mandible and associated floor of the mouth containing the carcinoma is in continuity with the specimen already dissected in the neck up to the submandibular region. Where it is possible, the hyoglossus muscle together with the hypoglossal nerve can be retained and this will be possible for a carcinoma far back in the oral cavity where such a carcinoma overlies the

mandible opposite its angle. However, no attempt should be made to preserve these structures if such preservation in any way jeopardizes complete eradication of the tumour.

DISSECTION OF THE MASTOID-MANDIBULAR FOSSA

When the portion of the mandible has been removed, access to this fossa is excellent. As the dissection proceeds cranially the internal jugular vein is separated from the interval carotid artery and the muscles arising from the posterior tubercles of the upper cervical vertebrae and is divided as it leaves the skull. The sternomastoid and digastric muscles are divided at their bony attachments. The accessory nerve is divided, with the internal jugular vein, at the base of the skull.

A portion of the parotid salivary gland has already been removed, but the amount of such removal depends on the situation of the growth in the oral cavity. When the tumour is posterior then the greater portion of the salivary gland must be removed to allow incorporation of the parotid lymph nodes in the dissection. However, in all cases, it is possible to preserve the temporo-facial branch of the facial nerve and thus allow normal function of the orbicularis oculi muscle.

When the mandible is not divided the dissection of the mastoid-mandibular fossa is carried out by retraction of the mandible forwards. Removal of the posterior belly of the digastric muscle and division of the external carotid artery allows access to this fossa and the dissection can proceed up to the base of the skull where the internal jugular vein and the accessory nerve are divided. The glossopharyngeal nerve is seen as it turns forward over the stylopharyngeus muscle into the pharynx.

WOUND CLOSURE

When the oral dissection has not involved removal of portion of the mandible, reconstitutation is accomplished easily by insertion of wires through the drill holes made previously thus opposing the divided symphysis and reconstituting the bone. The soft tissue repair is most easily accomplished if the mucosa covering the inner aspect of the mandible is mobilized to free the mucosa lining the cheek. This allows the mucosa to be brought medially and opposed to the cut mucosa of the tongue. The sutures of chromic catgut are inserted so that the knots are tied on the deep surface. It is quite easy to obtain mucosal apposition between the cheek and the tongue, although some difficulty is experienced anteriorly where the tongue is attached to the mandible. There is little mobility of the mandibular mucosa in this region and it is somewhat difficult to hold the tongue in position.

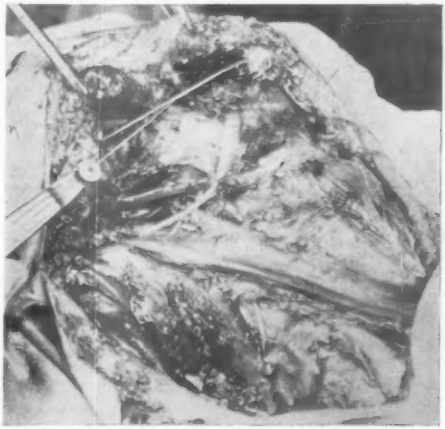

FIG. V. Photograph of the operation after suture of the mucosa of the cheek to the mucosa of the floor of the mouth showing:—

1. a Kirschner wire inserted into the two cut surfaces of the mandible and
2. the carotid arteries and the vagus and hypoglossal nerves.

When a portion of the mandible has been removed, it is even easier to suture the mucosa lining the check to the mucosa covering the tongue. Again difficulty may be experienced posteriorly where mobility of lateral mucosa cannot be obtained and to a lesser extent anteriorly depending on how far forward the bone has been divided. The two cut surfaces of the mandible are kept in position by the insertion of a stout piece of Kirschner wire placed into each divided end (Fig. V). This manoeuvre enables the point of the chin to maintain its central position. No attempt is made to reconstitute the mandible by insertion of either a bone graft or an acrylic prosthesis at this stage (Pollack, 1955), this procedure being delayed until after an appropriate interval of freedom from disease.

After reconstitution of the floor of the mouth and either suture of the divided mandible at the symphysis or insertion of a stout

Kirschner wire to maintain correct position of the cut surfaces of the mandible after excision of portion of that bone, the skin wounds are closed. This again is easy provided that skin has not been excised because of its involvement by tumour. Removal of neck skin may necessitate a plastic procedure for wound closure. A moderate sized rubber drain tube is inserted into the lower end of the wound. Suction is applied to this tube and air withdrawn from under the skin flaps, thus allowing the flaps to come into apposition with the deeper tissues. The drain tube is then connected either to an underwater seal or to an apparatus to provide continuous negative pressure in the wound. This procedure prevents the collection of serum in the wound and allows early adherence of the skin flaps to the dissected area. It obviates the use of massive dressings, makes nursing an easy problem and ensures rapid and sound wound healing.

It is not necessary to perform a tracheostomy unless the symphysis menti has been removed with consequent loss of the normal bony attachment of the tongue. Under these circumstances a tracheostomy is essential. However, if there is the slightest doubt concerning adequate bony attachment of the tongue at the end of the operation, a tracheostomy should be performed as it adds no hazard to the operation and closes rapidly later. In 9 combined neck and mouth dissections, a tracheostomy has been found necessary on one occasion only and this was when the portion of mandible removed included the symphysis menti.

POST-OPERATIVE MANAGEMENT

(a) Feeding.

With such extensive oral procedures, the patient finds difficulty in swallowing in the early post-operative days. Fluid is therefore necessary by the intravenous method and also through the Ryle's tube. The tube is withdrawn at the earliest moment as its presence often leads to the development of bronchopneumonia in these elderly patients. Within two or three days after the operation the patient is able to swallow fluids and he is then placed on a high protein, high caloric, high vitamin, vitamized diet.

(b) Mouth toilet.

It is essential that frequent saline mouth toilets be carried out by the nursing staff as it is quite impossible for the patient to do this himself by irrigation and by movement of the tongue. In fact it is essential that tongue movements be limited to a great degree and such limitation will aid healing of the suture line between the tongue and the cheek mucosa. Since the tongue is so highly muscular and as it is impossible for the patient not to move the tongue, it is common to find the tongue breaking away from its cheek attachment where mobility is least. This occurs either anteriorly where the tongue is sutured to the mucosa of the lower lip or posteriorly where the tongue is sutured to the mucosa in the region of the divided mandible. It is almost always found that breaking away to a greater or lesser degree occurs, but provided the skin wound is healing satisfactorily, communication between the mouth and the exterior through the skin wound does not develop.

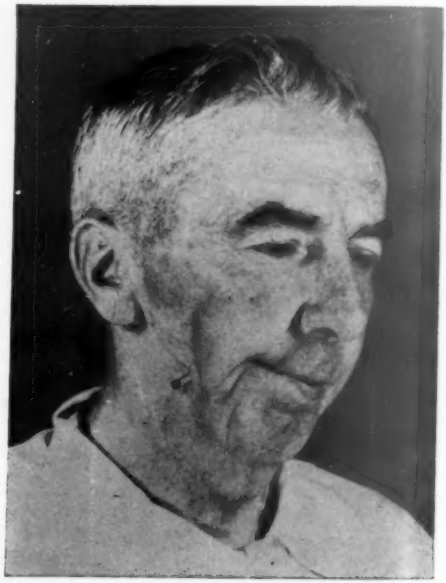

FIG. VI. Photograph of a patient after right combined neck and mouth dissection with removal of portion of the mandible. A bucco-cutaneous fistula is indicated by a probe. Negative pressure drainage was not used in this patient; as a result serum collected beneath the skin flaps, slight skin separation occurred superiorly and the fistula developed. This was closed several weeks later.

Even if such breaking away of the mucosal suture line is considerable exposing a large cavity which is rapidly covered with slough,

healing of this cavity is rapid, even surprisingly so. The patient experiences no great discomfort when this happens, provided that the skin wound does not give way and no communication is established between the mouth and the exterior. When both skin and mucosal sutures give way, a bucco-cutaneous fistula develops which is very worrying to the patient (Fig. VI). However, no effort is made to close such a fistula until the mouth cavity wound has healed and the whole area has softened. This usually takes some weeks and by that time the fistula is quite small and is readily closed by mobilizing both skin and mucosa and suturing each meticulously. If the fistula is large a plastic procedure is necessary to obtain closure (King, 1956).

(c) Collection of serum in the upper part of the neck dissection is abolished by using negative pressure drainage and this allows rapid wound healing. Serum tends to collect low in the neck under the posterior skin flap after the drain tube is removed which is normally done on the fourth or fifth post-operative day. Evacuation of such serum collection frequently over a period of two or three days allows the posterior skin flap to adhere to the underlying muscle and the collection of serum ceases. It is rare to find any infection developing under the skin flaps since this is largely obviated by preventing the collection of serum and by using an appropriate antibiotic cover. Sutures are removed from the skin wound between the seventh and tenth day. Considerable oedema of the cheek sometimes develops, but this slowly subsides and requires no specific treatment. Although portion of the parotid salivary gland is removed, a salivary fistula does not occur.

(d) Osteomyelitis may develop in the end of the divided bone and this necessitates removal of diseased bone to allow mucosal coverage and sound healing. If osteomyelitis develops, the Kirschner wire must be removed.

(e) The patient finds difficulty in speaking for some time after these radical procedures, but despite removal of portion of the tongue and of the mandible, often to a considerable degree, speech ability returns practically to normal in due course.

(f) The patient is made ambulatory early and usually he is got out of bed the day following operation. This procedure improves the patient's sense of well being considerably and plays no small part in the low operative mortality which accompanies these extensive operations in elderly people. There have been 3 post-operative deaths in 72 neck dissections, only one of which occurred (on the fifteenth post-operative day) when a combined neck and mouth dissection had been performed.

(g) The amount of pre-operative radiotherapy given has not significantly influenced neck or mouth healing in this small series of combined neck and mouth dissections. Post-operative radiotherapy is not indicated as adequate surgery eradicates the growth, its local spread and its metastases. One must never rely on the radiotherapeutist to cover an inadequate operation.

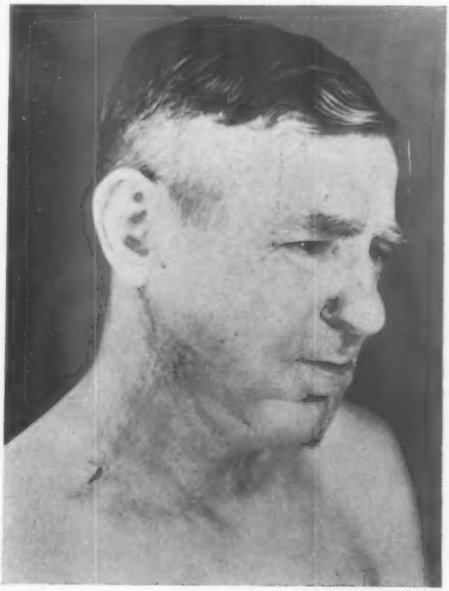

FIG. VII. Photograph of the patient (on whom the photographs of the operation were taken) on the fourteenth post-operative day showing healing of the skin wounds except for the drain tube opening used to apply negative pressure in the wound for the first few days.

JAW RECONSTRUCTION

No deformity follows an intra-oral procedure for soft tissue carcinoma after the post-operative swelling has disappeared. The use of wire to oppose the divided mandible is sufficient to ensure the immobility necessary to secure bony union, although such bony union is slow to become complete.

The deformity which results from excision of a portion of the body of the mandible with preservation of the symphysis is not great (Fig. VII). When bone removal includes the symphysis menti there is a marked deformity, although the patient tolerates this well when the position is explained to him. After a sufficient period of time has elapsed to make cure a probability, jaw reconstruction by insertion of a bone graft or acrylic prosthesis can be undertaken.

By the time such an operation is contemplated, all tissues are exceedingly soft, easily mobilized and heal rapidly. It is most important in the management of these patients that their future be fully discussed with them and the possibility of insertion of a bone graft later to correct the deformity be held as a reward for tolerance of this deformity.

CASE REPORTS

Case 1

Mrs. A.M., aged 72, first presented with an ulcer on the right margin of her tongue in December, 1955. A biopsy of this ulcer revealed it to be a squamous epithelioma. The tumour was infiltrating the tongue deeply, and it was treated by the insertion of radon needles. During the patient's stay in hospital for treatment, she suffered a pulmonary embolus from which she recovered slowly. The radiotherapy treatment resulted in complete healing of the ulceration but did not result in eradication of the deep infiltrating portion of the tumour as it invaded through the mylohyoid muscle into the submandibular region. In addition, she developed metastases to the submandibular lymph nodes.

Because of this failure to control the primary growth and because of the spread through the floor of the mouth and the involvement of the submandibular lymph nodes, she was referred to the writer for surgery. The position of the tumour and the fact that she had already been treated by a radon implant indicated radical surgery with division of the symphysis menti to expose the oral cavity and allow a combined neck and mouth dissection to be carried out in continuity. The patient was therefore re admitted to hospital and the operation was performed in April, 1956 (Fig. VIII). The technique of the operation was as has been described and repair of the mouth was quite satisfactory. The mandible was sutured with wire and the neck wound drained to an underwater seal and negative pressure instituted.

The patient made a good recovery, but by the end of one week the portion of the tongue remaining had become detached from the mucosa on the inner aspect of the mandible anteriorly. The tongue remained attached to the mucosa of the cheek posteriorly where greater mobility of lateral soft tissue was present.

The skin wound healed well so that despite giving way of the oral suture line, a bucco-cutaneous fistula did not develop. With frequent mouth toilets the deep cavity in the mouth resulting from the tongue losing its attachment rapidly healed. The patient developed pain in the calves of her legs on the eighth post-operative day and because of her previous history of embolism it was considered wise to place her on anticoagulent therapy. This was done and no pulmonary embolus occurred.

FIG. VIII. Photograph of a specimen removed by combined neck and mouth dissection (Mrs. A.M.) showing the lateral half of the tongue and floor of the mouth in continuity with the dissected tissue from the neck.

The patient was up and about and almost ready to go home with the neck and mouth wounds quite healed and able to take vitamized foods easily. Suddenly on the fifteenth post-operative day she had a severe cerebral haemorrhage, immediately became unconscious and died within three hours.

Despite this patient's age, she stood the extensive operative procedure extremely well and at no time caused anxiety. She was able to take fluids the day after operation and shortly afterwards she could take vitamized food. Her convalescence was quite smooth, except for the phlebothrombosis, until the cerebral haemorrhage occurred. Since she was on anticoagulent therapy at the time of occurrence of the haemorrhage, bleeding was severe and death rapid.

Case 2.

Mr. M.F., aged 54, presented in May, 1956, with an ulcer in the oral cavity situated over the left half of the mandible at the junction of the ramus and the body. The ulcer measured 3 cm. by 2 cm. in size and was quite deep. Submucosal infiltration extended upwards into the cheek and downwards into the floor of the mouth. Biopsy revealed the presence of a squamous epithelioma and X-ray examination showed involvement of a considerable portion of the mandible. No metastases to lymph nodes could be detected.

FIG. IX. Photograph of a specimen removed by combined neck and mouth dissection (Mr. M.F.) showing the left half of the mandible (involved by growth) in continuity with the dissected tissue from the neck.

Treatment was planned to include both radiotherapy and surgery. A course of radiotherapy was given to control and eradicate the spread of tumour into the soft tissue of the cheek. This treatment was effective in controlling this spread and six weeks later a combined radical neck and mouth dissection was performed to include removal of the mandible from in front of the mental foramen to just below the mandibular notch. A considerable portion of the floor of the mouth was also removed with the mandible and the combined neck and mouth procedure was well clear of the growth as shown by pathological examination (Fig. IX).

The wounds were closed by apposition of the side of the tongue to the mucosa of the cheek and pharynx. Negative pressure drainage was instituted. The patient was able to swallow fluid the next day, but five or six days later the posterior portion of the tongue tore away from its attachment to the cheek and this left a large cavity between the tongue and cheek extending downwards to the skin suture line. However, no serum collected in the neck and the skin wound healed, so that a bucco-cutaneous fistula did not eventuate.

The large cavity thus produced healed extremely rapidly and when the patient left hospital three weeks later, both mouth and neck wounds were well healed. The wounds became quite supple and the wire inserted to hold the symphysis of the mandible forward and in a central position was very satisfactory. The patient was soon able to eat semi-solid food.

Case 3

Mr. W.M., aged 27, presented in October, 1955, with a swelling on the left side of the lower jaw of nine weeks duration.

Examination revealed a tumour 4 cm. in diameter, quite hard and apparently involving the mandible. There was no evidence of ulceration and biopsy of the mass revealed it to be a squamous epithelioma.

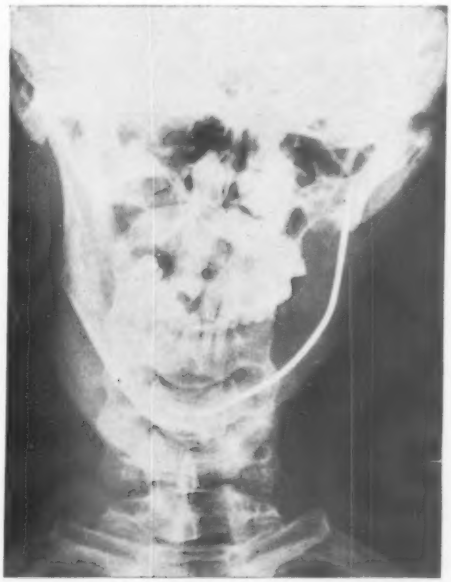

FIG. X. Photograph of an X-ray of the mandible (Mr. W.M.) showing the wire holding the two cut surfaces of the mandible apart.

Operation for removal of the mandible from just in front of the mental foramen to the region of the mandibular notch, together with dissection of the submandibular region was carried out and a wire was inserted to keep the two cut surfaces of

the bone apart (Fig. X). The tongue was sutured to the mucosa of the cheek and both buccal and skin wounds healed rapidly.

Examination of the specimen excised showed it to be a squamous cell carcinoma on the outer aspect of the jaw. This was invading the outer portion of the mandible and accounted for the X-ray appearance of an irregular area of osteoporosis approximately 4 cm. by 1.5 cm. in extent in the mandible.

The patient was discharged on the sixth post-operative day with all wounds well healed. The wounds rapidly became supple and later reconstruction of the jaw will be undertaken.

SUMMARY

The technique of combined neck and oral dissection for oral carcinoma has been described.

Indications for this procedure have been mentioned and illustrative case reports given.

ACKNOWLEDGEMENT

The photographs are the work of Mr. R. Inglis, Clinical Photographer at the Royal Melbourne Hospital, and to him I am greatly indebted.

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APPOSITION AND DRAINAGE OF LARGE SKIN FLAPS BY SUCTION

By G. E. Moloney

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THERE has long been a need for improvement in our methods of obtaining apposition of large skin flaps to underlying tissues and obliteration of surgically made spaces, and the drainage of their exudates.

The value of sealed drainage of wounds has been emphasized by Sheppard (1952), and though it is now an established practice by some surgeons, it is still not widely appreciated. Sheppard has shown that the drainage tube from any wound may be connected to a length of collapsible, thin-walled rubber tubing which forms an air and fluid seal. The principle may be applied to any area of the body, and he cites its use after radical mastectomy, operations on the gall-bladder, kidneys and prostate, and in the perineal wound after rectal excision.

A further step onwards in the technique of closed drainage is recorded by Raffl (1952) who emphasizes the use of a negative pressure in the sealed drainage system. Raffl's announcement of this principle is a model of brevity, and he mentions its use only in connection with radical mastectomy.

The present intention is not only to add support to the method when used after breast operations, but also to show other ways in which I have found the principle may be applied. For the past three years I have used the method for the skin flaps after radical dissection of the glands of the neck and groin, after thyroidectomy, and in other situations, and more recently after amputation of the limbs.

Silvis *et alii* (1955) have also used the method after neck and groin operations, and found it equally successful.

By this technique large flaps of skin can be readily approximated to the underlying raw areas with rapid adherence and healing, and a minimum of scarring with a quick return to normal function.

In the familiar practice of bandaging over skin flaps it is usual to cover the wound and a surrounding large area of the patient with a goodly portion of gauze, a great bulk of wool, and then to encase it all with several yards of bandage or lengths of strapping, thus forming a sponge into which soak blood and serum, turning a large part of it into a bloody morass which in turn may drip its contents on to the bedclothes. A patient with such a dressing suffers pressure over a large area in the hope that some is distributed to the outer aspects of the skin flaps, thus forcing them on to the underlying tissues. The method is not without success, failure, discomfort and expense.

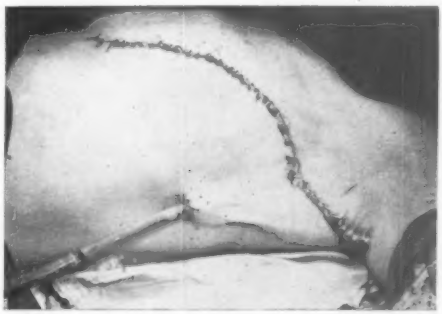

FIG. I. Showing skin suture after radical mastectomy using interrupted stitches and clips, drainage at the most dependant point by a stab wound in the skin cleavage line, the drainage tubing connected to the source of suction in the theatre.

In the neck, application of pressure by a bandage is nearly impossible without suffocation, and on the chest wall respiration is impeded, and in both the chest wall and the groin the circulation which is already restricted in the flaps is impeded by the external pressure, and in consequence marginal or more extensive sloughs are not uncommon. Pressure is seldom uniform so that blood and

serum collections with tenting of the skin flaps are common and defy forlorn attempts to prove that fluids are compressible.

FIG. II. Showing the spigot inserted into the tubing to maintain a negative pressure during the patient's transport to the ward.

How much better it is to remove the blood-soaked uncomfortable dressings, to connect a source of negative pressure to the drain and so apply an "atmospheric bandage" to exert a diffuse, and evenly distributed pressure. Dressings are reduced to a thin layer of gauze which protects the wound both from infection and from inspection in the early distressful days. Care, as ever, is necessary in the first few hours after operation to look for loculations of blood which can occur, but they are easily recognized with most of the flaps visible and palpable due to the small dressing, and such collections can be milked towards the drainage tubing. A change of dressing is usually unnecessary until the stitches and clips need to be removed so that there is a great saving in dressings and in nursing time. Although some reduction of movement of the affected area is preferable the patient can move more freely. Healing is rapid, and tenting of the flaps from air, blood, or serum collections which call for aspiration and produce slow healing with fibrosis and restricted movement, is virtually eliminated.

GENERAL DETAILS OF TECHNIQUE

(1) Wound closure should be airtight and, for this purpose, interrupted stitches and clips (Figs. I and X) produce an airtight wound as effectively as a continuous stitch, and give a much better scar. I do not use "tension" or "relaxing" sutures but rely on frequent stitch or clips at the wound edges to hold the flaps together. Tension sutures are unnecessary and produce ugly scars.

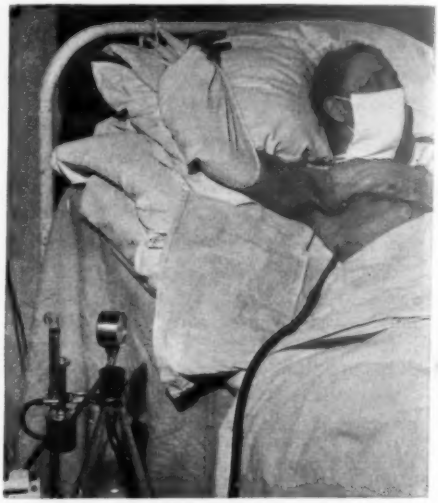

FIG. III. Illustrating the source of negative pressure in the ward, in this instance, a suction pump, connected to the drainage tubing. The dressing is removed for photographic purposes only. The method of maintaining abduction and external rotation of the arm is shown.

(2) The stab wound for the drain should be just long enough to surround the tubing closely, or be reduced by a stitch to do so. Should the main wound be used for the drain, the closure around the tube should be made airtight. The most dependent point should be chosen to make the stab (Fig. I).

(3) Suturing of the tube when the drainage tube (or tubes) has been positioned is best done by a stitch through the skin on each side, which is tied around the tube but does not penetrate its lumen so that drainage is not impeded. Thread is a good anti-slip material for tying drainage tubes (Fig. I).

(4) The drainage tubing may be specially prepared as has been done by Sheppard (1952), or may be cut at the time required. Several holes at various points around the tube should be cut, the tube should be long enough to extend over most of the wound, and the holes in it should be made nearly to the point of exit to prevent loculations. Holes should not be so large as to allow easy kinking of the tube. A thick walled tube which

will not readily collapse and with a wide bore is preferable. Sometimes two or more drains may be desired, and a T- or Y-piece can be used to connect them to a common suction tube (Figs. XII and XV).

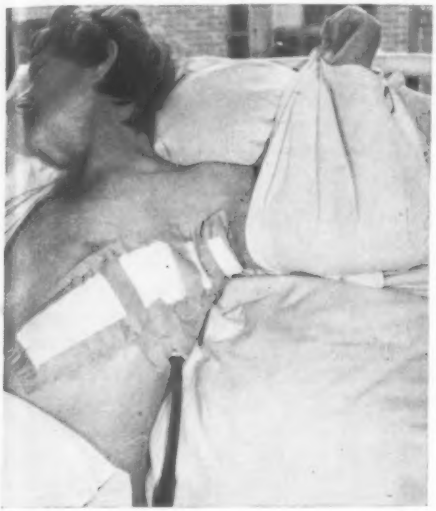

FIG. IV. An illustration of the simplicity of the dressing and its mode of fixation for both the main and stab wounds. Also shown is the method of maintaining abduction and external rotation of the arm.

(5) The skin flaps should be inspected frequently in the first few hours to ensure that there are no air leaks and that loculi of serum or blood are not forming. They are uncommon, but if present should be milked towards the tubing.

FIG. V. The method of placing the drainage tubing in the axilla.

(6) The suction is started on the operating table by connecting the suction tubing used during the operation with a glass connection to the drainage tube (Fig. I). There is a sudden collapse of the skin flaps on to the underlying tissues, and close apposition at all points is assisted by coaxing any small collections of fluid towards the drain. The tube is then clamped and a spigot put into its end (Fig. II). The wound is dressed and the suction reapplied, and the tube respigotted for transport to the ward. On reaching the ward the drain is connected to a source of suction which can be either a bottle with a negative under-water seal, or an electric or water pump. In the first twenty-four hours I prefer (but it does not appear to be essential) the stronger suction of the electric pump, and after that an under-water seal with about 20 cms. of negative pressure of water does very well. Another method of obtaining a negative pressure is by the use of a syringe of the Dakin variety which is attached to the drainage tube after the rubber bulb has been compressed. It gives a means of suction which is readily portable for ambulant patients.

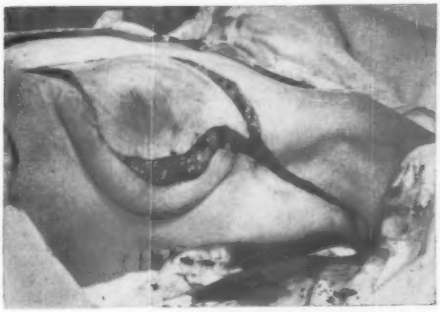

FIG. VI. Showing the posteriorly placed incision with the large anterior flap which results in no reduction of exposure, excellent function with no webbing, and greatly improved appearance.

(7) The dressing is very simple, consisting of a thin layer of gauze along the wound which protects it from the bedclothes and hides it from the patient's sight (Fig. IV). It may be simply fixed by a length of one-inch strapping along the edge of the gauze, half on dressings and half on the skin, with occasional cross pieces of strapping as needed. The dressing is usually not disturbed until it is time to remove the sutures and clips.

The drainage tubing issuing from the stab wound is surrounded by a piece of gauze which is fixed to the skin by strapping (Fig. IV).

This simplicity of dressing results in a reduction of pain and discomfort to the patient, as well as in a saving of materials and time

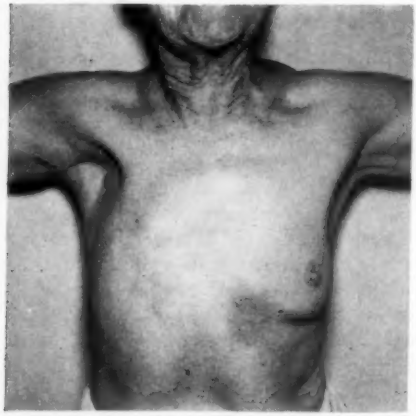

FIG. VII. Illustrating a result after suction drainage, and a posteriorly placed incision. There is no webbing. Though the incision is made well posteriorly, the undercutting usually allows the scar to come a little forward and to be across the axilla, but with no detriment to function.

SPECIAL REGIONS

(1) After radical (and simple) mastectomy

Accurate haemastasis is as desirable as ever. A stab wound is made in the skin cleavage line at the posterior and inferior aspect of the lower flap (Fig. 1). The drainage tube is placed along the medial wall of the axilla to about one-half of an inch below the neuro-vascular bundle (Fig. V). The flaps should be placed temporarily in the way they will lie when the wound is sutured and the drainage tube is then placed in position and fixed by a suture. Then the skin edges are closed, the dressing applied, and suction tubing fixed to the drain. In the ward the usual routine is suction by machine for one to two days, and under-water suction for another two to three days, the tube being shortened usually on the fifth day and removed on the sixth day. There may be a moderate serous discharge for a further three to four days, longer sometimes. The arm is held by pillows and sling into abduction and external rotation for four days (Fig. IV), and may then be brought to the side with intervals of abduction and general use during succeeding days. Skin adherence is rapid. The results are shown in Table 1.

TABLE 1

RESULTS AFTER RADICAL MASTECTOMY

(Own Operations, 1953-55)

Total operations	32
Primary, uneventful healing	21
Minor slough of wound edge (all healed in less than three weeks)	6
Moderate slough of wound edge (infective, both healed in six weeks)	2
Serum aspirated (1, an ounce only: 1, required re-insertion of drain)	2
Profuse bruising (? blood dyscrasia)	1

Additional note on the incision and flaps in radical mastectomy.

Since using the system of suction to the flaps I have reverted to an incision which is carried across the lower part of the axilla (Fig. VI), thus making a long anterior flap to cover the axilla after the wound has been sutured. When using the system of gauze, wool and bandage, incisions made across the axilla often resulted in the formation of a web which would reduce abduction to a varying degree, and give an unsightly appearance. With the present system this either does not occur (Fig. VII) or does so only to negligible degree, and good abduction is the rule (Fig. VIII). The posteriorly placed axillary scar is seen only in abduction, and the general appearance is much better (Fig. IX).

(2) After block excision of glands of neck

Fig. X shows the application of the technique. The drain should extend up to the angle of the jaw and be liberally holed just to the point of exit.

The dressing is minimal (Fig. XI) and the patient can move the head readily with obvious improvement in comfort. After the drain is removed a small dressing over the site of the drainage wound is necessary for a few days to catch the seepage from the

track. When used on 6 occasions there has been rapid primary healing without complications.

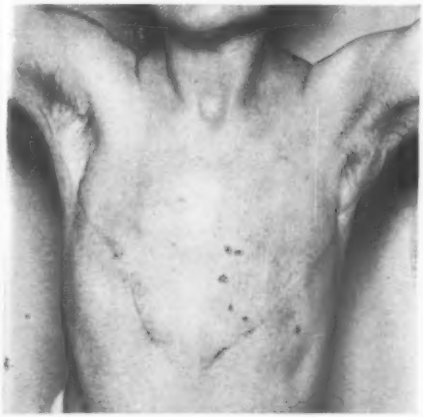

FIG. VIII. After a bilateral radical mastectomy (different histology). Rapid healing with minimal fibrosis, no webbing, and full abduction.

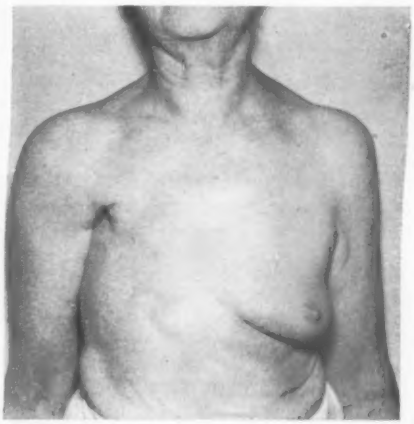

FIG. IX. With the arm in the position of most frequent use no scar is visible above the fold of the axilla.

(3) After block excision of glands of the groin

The usual attempts to apply pressure by a bandage in this area are unlikely, because of leg movement, to preserve a uniform pressure in the skin flaps, and such pressure does much to deprive the flaps of an already depleted blood supply. This region has been notorious for the tenting or sloughing of skin flaps. Suction is best applied by two drains, one at each end of the wound and one beneath each flap. The tubes are joined by a common T-piece strapped to the thigh and to which suction by a machine is applied for four days. In 4 instances where suction was used in this way there was primary healing of the flaps. The technique suggests itself as admirably suited to the operation of excision of the vulva with bilateral block excision of the groins.

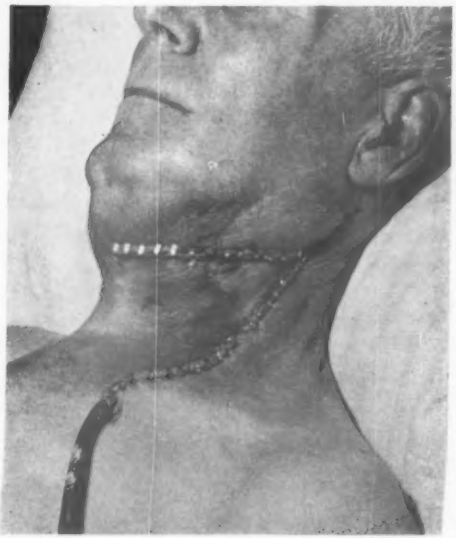

FIG. X. After block excision of the glands of the neck, a further illustration of the method of skin closure, and the collapse of skin flaps on to underlying tissues when suction is applied.

(4) After thyroidectomy

After lesser operations I do not always use a drain, but, if employed, then a tube or piece of corrugated rubber passing into a dressing is satisfactory. Where there is much oozing or a large gland has been taken away I use under-water suction drainage. A drain is placed at each end of the wound (Fig. XII), one passing through a stab in the deep fascia to the thyroid bed, and the other lying along the lowest limit of the lower flap, these tubes being joined by a Y-glass connection piece to a source of suction. The more gentle suction provided by under-water drainage is entirely sufficient as the viability of the flaps is not impaired, and it is merely a question of early healing and good clearance of blood and

serum, and of general comfort and tidiness. Suction is used only for twenty-four hours, and, after removing the drains, sutures previously inserted at the operation at the site of the drainage tubes are tied (Fig. XIII). The small dressing is comfortable, and the absence of blood in both dressing and clothes does much to reduce the alarm of both patient and relatives occasioned by bulky, bloody dressings. The tubing may look a little cumbersome as depicted in Figs. XII and XIII, but in practice the tubing lies in the patient's clothing and is mostly hidden. The upper part of the tubing as it curves away from the wound is best held to the chest wall by strapping. After 31 partial thyroidectomies performed during 1953-55, suction drainage was used for preference in 10 instances, the only complication being one wound infection by *Staphylococcus Aureus.*

FIG. XI. This illustrates the simplicity and comfort of the dressing on the neck after block excision of the glands.

(5) After excision of a large lesion on the back

After removal of a large pigmented area from the small of the back, large skin flaps were undermined and the edges then sutured. The skin flaps were sucked on to the deeper tissues and rapid, sound primary healing resulted.

(6) After amputations of the limbs

I have just recently applied the technique to amputation stumps, and have used it twice for above knee (Fig. XIV) and once for a below knee (Fig. XV) amputation. Thin

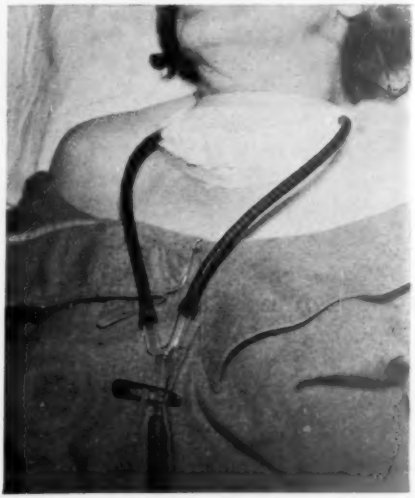

FIG. XII. After partial thyroidectomy showing one drain to the deep tissues and the other beneath the flaps both connected by a Y-tube to a source of suction. The comfort of the simple dressing is obvious.

FIG. XIII. Showing the sutures in the skin ready for ligation when the drainage tubing is removed.

gauze dressings were applied, tight devitalizing bandaging being unnecessary to keep the flaps compressed. Any further dressing around the stump should be loosely applied to act as a protective only, and the suction tubing may be strapped to the limb and brought up to the surface at the proximal end of the dressing.

(7) After thoracotomy

The use of negative pressure drainage is so well known that it does not need any description; but it is mentioned here to put it into perspective with these other newer uses.

FIG. XIV. After an amputation through the thigh, a single drainage tube is connected to a source of suction. The dressing and inspection of the stump are much simplified.

SUMMARY

The use of suction for drainage and apposition of skin flaps to underlying tissues, already described for use after radical mastectomy, has been applied to other areas where skin flaps and dead space remain after operations, notably in the neck, groin, and in amputation wounds.

The advantages of the method are stated, points of technique in general and for special areas are detailed, and results mentioned.

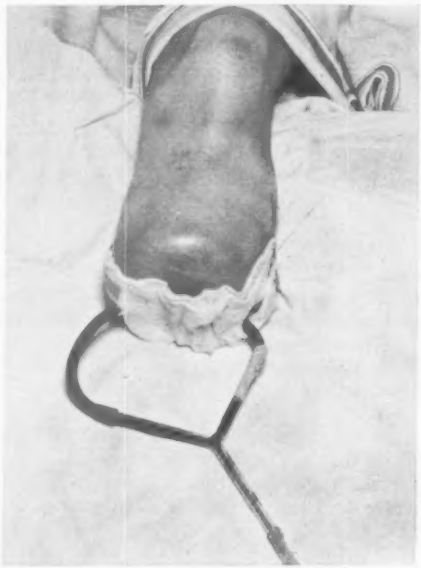

FIG. XV. After a below-knee amputation for arteriosclerotic ischaemia of the foot the flaps healed by primary union with the use of suction apposition and drainage.

ACKNOWLEDGEMENT

I am indebted to Mr. A. M. N. Gardner, my late registrar, who first showed me the use of drainage with suction for radical mastectomy.

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INTRACRANIAL TUMOURS: AN ANALYSIS OF 157 CONSECUTIVE CASES

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"CLASSIFICATION must be regarded as providing merely arbitary pockets into which we can place tumours of similar character in order that they may be more easily considered . . . Placing two or more of them together is defensible only if their general characteristics are sufficiently similar to make such grouping of value to those, pathologists and clinicians, who have to deal with them. The pathologist will always seek to spread the classification wider and wider until the ultimate and natural point is reached at which each tumour differing as it does from each other occupies a little class all its own. The clinician, on the other hand, seeing only the grosser aspects of the problem, will persistently tend to narrow the classification. . . ." (Bucy and Gustafson, 1939).

This review of pathological material has been made possible as a result of the development of the neurosurgical unit at Vellore; it represents the largest series of intracranial tumours reported from India. The series would have been much larger if unconfirmed clinical material had also been used but only those cases in which an adequate biopsy specimen was obtained at operation or in which an autopsy was performed are reported. The incidence of tuberculomata cysticercosis and torulosis in space occupying lesions of the brain is discussed at the end of this paper.

The specimens were obtained over a five-and-a-half year period (November, 1949, to April, 1955). In 134 cases tissue was studied from surgical material, in 39 of these cases autopsy had also been performed and in 23 additional cases the material was obtained only at autopsy. The total number of autopsies in the series was 62 (42 per cent.). The analysis is a continuation of the report by Gault *et alii* (1953).

Historical

Virchow (1864-65) introduced the term Neuroglia (nerve glue) in 1853 and he was also responsible for the term Glioma. He disentangled the tumours of this group by modifying and clarifying the concept that they arose from nerves. He objected to the terms Cephaloma and Medullary Carcinoma which, he felt, were too non-specific although he still applied the term Sarcoma to the more cellular and rapidly growing glial tumours. He pointed out that there was a difference in the consistency of glial tissue in the tumours at different points. He also referred to the difficulty in distinguishing diffuse hyperplasia from tumour tissue and in 1846 showed the presence of neuroglia at the surface of the ventricles. He observed areas of what he termed *gliome* and *sarcome* in the one tumour. He considered that there were two main types of tumour; one of these contained strands of intercellular substance so that the tumour closely resembled a fibroma and the other which was very cellular and resembled a sarcoma. The different microscopic types were described in detail but variations between these different types were often found in the one tumour.

Modern Methods of Classification

In 1926 Bailey and Cushing presented a classification of brain tumours in terms of the cell type present but unfortunately they followed too closely Cohnheim's rest theory and put an embryological interpretation, which is no longer tenable, on the origin of many of these tumours. They suggested 14 major categories based on the development of a tumour from one or other of the 20 different cellular types of neuroglial cell at various stages in its development and attempted to correlate these cell types with the growth characteristics of the tumour. In broad terms this concept has proved of great value in the study of intracranial tumours but the attempts to divide and subdivide the glioma group have led to much confusion. Willis (1953) puts the matter succinctly when he states that the classification of Bailey and Cushing "was unnecessarily complex and its

terminology introduced embryological concepts which were not warranted."

Cox (1933) has pointed out that the different types of glioma depend on the degree of anaplastic change present—"The cells of glioblastomata possess every characteristic peculiar to anaplastic tumours, that is to tumours composed of undifferentiated cells derived from more adult elements." Russell (1939), Courville (1945) and Bodian and Lawson (1953) have expressed similar views. Russell (1939) showed considerable areas like astrocytoma in tumours of the spongioblastoma multiforme type and demonstrated that consecutive examination at biopsy and necropsy separated by considerable intervals of time demonstrated marked differentiation in tumours primarily astrocytomata. Bailey (1932) modified his original position and claimed that the basis for the classification was purely morphological, reduced the original fourteen groups to 10 and claimed that the doctrinal idea had been only used to explain the structure of medulloblastoma.

The concept of histological as opposed to histogenetic classification received further confirmation by the work of Scherer (1940) when he found areas of glioblastic tissue in what had been thought to be a benign tumour. He showed that there were transitional stages between astrocytes and oligodendrocytes. He believed that the cellularity of a tumour had a relation to the age of the tumour and that most of the glioblastoma group developed from astrocytomata by a process of de-differentiation if there had been a long enough period of clinical development. This has been further supported by Penman and Smith (1954) who reported a series of 298 gliomata in which astrocytomata were most common between the ages of 30 and 39 and glioblastoma between the ages of 40 and 49.

Zimmerman and Arnold (1941) have induced tumours in the brains of mice with methylcholanthrene. Zimmerman (1954) has shown that a "pure" glioma never results but that the tumour is a mixture of cell types. He points out that the position of the carcinogen in the brain is important; ependymomata arise when carcinogens are placed in contact with the ventricular wall; medulloblastomata arise almost exclusively in the cerebellum and oligodendrogliomata appear in the subcortical white matter of the cerebral hemispheres.

This historical introduction would suggest that too fine and complicated a classification of the glioma group is no more justified than a similar classification of other malignant tumours. The site of origin may well be an important factor in determining the type of tumour which develops; if a neoplastic change occurs in the cells near the surface of a ventricle an ependymoma results; tumours in the subcortical region develop into astrocytomata and oligodendrogliomata and depending on their situation may draw attention to themselves before they have started to grow rapidly; deep seated tumours which may have been present for a considerable time often show a more active growth and are classified as glioblastomata. The actively growing tumour of the cerebellum in children (the medulloblastoma) bears many histological similarities to other rapidly growing malignant tumours in children as seen in the eye and the adrenal and this introduces the importance of age in relation to tumour structure and behaviour.

The age of a tumour cannot be accurately assessed from a patient's symptoms. Davie (1932) has commented that "the survival period of the slow growing tumours depends on other factors than their rate of growth, for example, their site with reference to the tentorium cerebelli, their proximity to the third and fourth ventricles or the aqueduct of Sylvius, the age of the patient, their accessibility to operative interference and their liability to produce metastases." Penman and Smith (1954) in their analysis of 298 gliomata consider that site probably outweighs the pathological type as a factor influencing survival. "When due regard is paid to age the cerebral hemispheres prove to be a site more favourable to long survival than the cerebellum." Between the ages of 0 and 9, infratentorial tumours were found four times more commonly than supratentorial. Between 10 and 19 there was about an equal distribution. Above 20 the supratentorial tumours were twenty times more common. Hooper (1955), in an analysis of 80 posterior fossa tumours in children under the age of 15, has found that two-thirds of the tumours in childhood were below the tentorium and in his series there were only two cases of glioblastomata.

TABLE 1

TYPE OF LESIONS

Type	No. of Cases	Percentage
Gliomata	71	45.2
Astrocytoma and glioblastoma		
Oligodendroglioma		
Ependymoma		
Medulloblastoma		
Encapsulated tumours arising from cranial nerves and meninges		
Tumours of cranial nerves	14	9.0 } 26.0
Meningioma	27	17.0 }
Pituitary and parapituitary tumours		
Pituitary tumours	13	8.2 } 11.4
Parapituitary tumours	5	3.2 }
Pineal tumours	3	2.0
Miscellaneous tumours	12	7.7
Secondary invasion	12	7.7

TABLE 2

COMPARISON OF THE OBSERVED PERCENTAGE INCIDENCE FROM A SERIES OF AUTHORS

Type	Various Authors	Cushing	Olivecrone	Vellore
Total No. of Cases	567	1,977	514	157
Glioma	59.9 per cent.	43.6 per cent.	54.9 per cent.	45.2 per cent.
Acoustic nerve tumour	5.2 „	8.9 „	12.9 „	9.0 „
Meningioma	16.6 „	18.8 „	16.0 „	17.0 „
Pituitary and parapituitary tumours	2.8 „	16.7 „	4.0 „	11.4 „
Pineal tumours				2.0 „
Congenital tumours	1.7 „	5.7 „	2.5 „	4.5 „
Blood vessel tumours	0.8 „	2.0 „	2.9 „	2.6 „
Papilloma	0.8 „			
Chordoma				0.6 „
Metastatic invasion	11.7 „	4.3 „	3.5 „	7.7 „
Sundry	0.5 „		3.3 „	

Modified from Kinnier Wilson (1940)

CLASSIFICATION OF TUMOURS IN THIS SERIES

Table 1 shows an analysis of the six main groups into which we have divided the tumours. The glioma group (45.2 per cent.) is easily the largest; the encapsulated tumours arising from cranial nerves and meninges (26 per cent.) is the next largest. The various tumours of this last group on account of age incidence, growth characteristics and in some cases histological appearance have much in common. The pituitary and parapituitary tumours come naturally together in view of their situation. The pineal tumours have certain peculiarities which make a separate grouping advisable. The miscellaneous group is an endeavour to avoid confusion by listing too many rare tumours separately.

TABLE 3

INCIDENCE OF GLIOMA TYPES

	Wilson (1,106 cases) Percentage	Vellore (71 cases) Percentage
Astrocytoma	41.0	45.0
Glioblastoma	33.7	19.8
Oligodendroglioma .	4.1	5.6
Ependymoma	5.4	8.4
Medulloblastoma ..	11.4	21.2
Sundry	4.4	

Modified from Kinnier Wilson (1940)

Table 2 shows a comparison between the types of tumour in this series with the incidence in three other much larger series. It is of interest to notice that the general pattern of incidence at Vellore follows that found in other countries.

(1) *Glioma Group*

Table 3 shows a comparison between the types of the glioma group of our series with a large series reported by Kinnier Wilson (1940). The much higher incidence of medulloblastomata may be accounted for by the fact that Vellore has a large and active paediatric department in the hospital. We have divided the tumours into five main groups realizing that even the attempt to separate astrocytomata from glioblastomata has difficulties and that intermediary types can be found between astrocytoma, oligodendroglioma and ependymoma.

TABLE 4

AGE, SEX AND SITE OF ASTROCYTOMA AND GLIOBLASTOMA

Age:	Highest	61
	Lowest	3½
	Mean	26
Sex:	Male	31
	Female	15
Site:	Frontal	12
	Parietal	9
	Occipital	5
	Temporal	2
	Suprasellar	1
	Subcallosal	1
	Lateral ventricle	1
	Cerebellum	9
	Medulla	1
	Third ventricle	5
	Fourth ventricle	2

(a) Astrocytoma and Glioblastoma (46 cases).

Table 4 summarizes the age, sex and site of this group. Multiple lobes were involved in 12 cases; basal ganglia in 6 cases. Of the cerebellar astrocytomata 3 were found in childhood (ages 3½ to 11) and 6 in adults (ages 15 to 30). The classification of these tumours into groups which have prognostic significance has been the subject of a number of papers by Kernohan and his colleagues at the Mayo Clinic. The dangers of this approach, particularly when biopsy material alone is examined, has been discussed in the opening section of this paper. We have regarded these tumours as belonging to a group of malignant tumours which vary from slow growing, well differentiated growths which we have labelled as astrocytomata to very cellular, and anaplastic tumours which we have called glioblastomata. Even in the apparently innocent tumours with a well differentiated histological appearance infiltration at the edge of the tumour is a frequent finding and any form of encapsulation is infrequent. The tumours of this group must therefore be regarded as being all malignant in their

nature. Pennybacker (1950) of Oxford in a review of 716 gliomata over an eleven-year period makes a typical English understatement when he refers to his "somewhat depressing" survey. This is supported by Rowbotham *et alii* (1955) who reported from Newcastle-on-Tyne only 7 cases out of 466 gliomata cured and of these 2 were haemangioblastomata (a very doubtful neuroglial tumour), 3 were cystic astrocytomata of the cerebellum and 2 were mucous cysts of the third ventricle. Their conclusion is that "the more experienced a surgeon becomes the less frequently is he inclined to operate on gliomata".

In an analysis of the age, site and type of these gliomata we found that in childhood two-thirds of the tumours were infratentorial while in adults there were only 6 infratentorial tumours and these were all in patients between the ages of 15 and 30 years. When the posterior fossa tumours as a group were examined histologically they were all astrocytomata except for one which contained a mixture of astrocytoma and glioblastoma. Tumours in this situation by interfering with the flow of cerebrospinal fluid produce symptoms of increased intracranial tension much earlier than tumours in other parts of the central system. It is suggested that they are seen at an earlier stage in the life of the tumour than lesions elsewhere and therefore tend to be of a purer type. Of the tumours in the cerebrum there were about equal numbers of astrocytomata and glioblastomata. In the superficial part of the cerebrum there were 9 astrocytomata and 13 glioblastomata, but all the astrocytomata were diagnosed from biopsy specimens and the picture may have been an inadequate representation of the tumour as a whole. Of the deep seated tumours 6 were diagnosed as astrocytomata (4 cases came to autopsy) and 3 as glioblastomata. As in the cerebellar tumours such deep seated tumours may have produced symptoms of increased intracranial tension at an early stage in the evolution of the tumour. One-third of the whole group came to hospital completely blind and another third came complaining of dimness of vision. This emphasizes the importance of the rise in intracranial tension in the series presented. The attitude of resignation, so frequently met with in India, results often in a failure of patients to present with neurological symptoms unless there is involvement of vision for which they believe (as a result of the extensive operative relief of cataract) treatment may give relief.

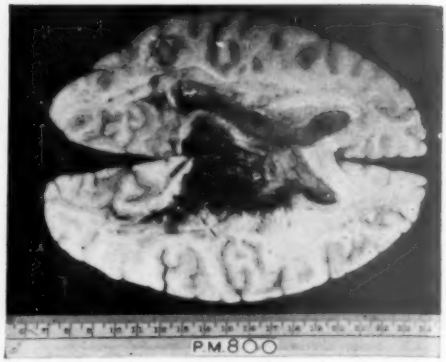

FIG. I. Photograph shows an extensive deep-seated glioblastoma involving the basal ganglia.

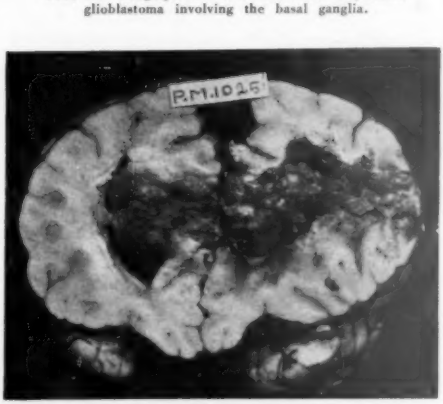

FIG. II. Photograph of another glioblastoma which involves the basal ganglia of both sides.

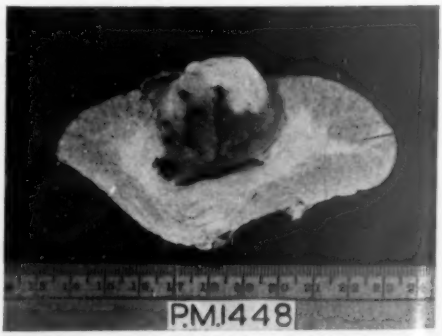

FIG. III. Photograph of a glioblastoma involving the pons and extending into the cerebellum.

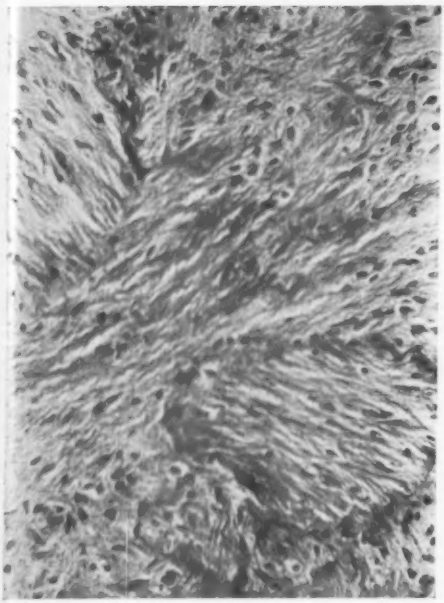

FIG. IV. Photomicrograph showing a more fibrillary form of astrocytoma with a pattern in the arrangement of the fibres. Haematoxylin and eosin (x 200).

Fig. I shows an extensive, deep seated glioblastoma involving the basal ganglia. Fig. II shows another deep seated glioblastoma which has involved the basal ganglia on both sides. Fig. III is from a patient in whom the glioblastoma involved the pons and extended into the cerebellum. The histological picture varied greatly in some cases and astrocytes were numerous but uniform in size with many fine fibrils between the cells. In other cases there was a less cellular and more fibrillary form of tumour. Fig. IV shows a fibrillary form of tumour in which there is a pattern in the arrangement of the fibres. In this case (a girl aged 10) the astrocytoma was in the suprasellar region. There was one example of the gemistocytic form of astrocytoma with a uniform type of cell which has more cytoplasm than the usual form of astrocyte. This tumour was found in a male patient aged 32 who had suffered from fits for seven months and developed hemipariesis. The tumour was located in the left parietal region. In the glioblastomata there was marked cellularity and considerable variation in the size, shape and staining of the nuclei. By contrast the cerebellar astrocytomata showed a very cellular but uniform appearance.

(b) Oligodendroglioma

There were only 4 cases in this group with a mean age of 31.5 as compared with 26 for the astrocytoma-glioblastoma group. They all occurred in male patients and were situated in the cerebrum. The vacuolated cytoplasm around a condensed nucleus was first described as "boxed in" by Bailey and Bucy (1929). Earnest, Kernohan and Craig (1950) found calcification in 69.5 per cent. of their 165 cases but in only half could the calcification be seen by X-ray examination. Calcification was seen in two of our cases. Two of the tumours were in the frontal lobe, one in the parietal and one in the suprasellar region.

Kwan and Alpers (1931) have described intermediary forms between oligodendrocytes and astrocytes. This subject has also been well discussed by Cooper (1935) who considered that they develop from the swelling and hyalinization of astrocytes. The slow growing character of this class was stressed by Bailey and Bucy (1929) who reported a total survival time of 96.7 months. The general conclusion seems to be that the oligodendroglioma is a degenerative form of astrocytoma with a relatively benign and slow course although James and Pagel (1951) have reported a case with extracranial metastases.

(c) Ependymomata

There were 6 cases which all occurred in males. The mean age was 25, the oldest was 39 and the youngest was 7 years of age. The tumour in this young boy was found in the parietal lobe with one area that resembled a neuroépithelioma. Fig. V shows an encapsulated cystic tumour found at autopsy in a girl aged nine. The tumour was projecting into the lateral ventricle in the occipital region. Fig. VI shows the typical arrangement of pseudo-rosettes and the perivascular arrangement of the cells with their large hyperchromatic nuclei. The presence of giant cells in one area suggested the diagnosis of ependymoblastoma. This tumour occurred in a boy aged 11 and was found in the occipitoparietal region.

Penfield (1932) mentioned the difficulty of distinguishing ependymoblastoma and neuroepithelioma. Globus and Kuhlenbeck (1942) were unable to demonstrate blepharoplasts

in a large group of ependymomata and this has been our experience. Ringertz and Reymond (1949) considered that ependymomata and choroid plexus papillomata are distinct tumours. Bodian and Lawson (1953) consider that ependymomata arise in a plate-like area of subependymal tissue and that they develop from astrocytes whose character is modified because of their situation near ventricles. The term subependymal astrocytoma would then be more appropriate than ependymoma.

FIG. V. Photomicrograph showing an encapsulated and cystic ependymoma projecting into the lateral ventricle found at autopsy in a girl aged 9 years.

(d) Medulloblastoma

There were about 15 tumours in this class and the malignancy of this group is emphasized by the note that 10 of these cases came to autopsy. The highest age was 25; the lowest 3; the mean was 10 years. The male sex predominated with 12 cases. The cerebellum was the site of 14 cases while one tumour mainly involved the pons and medulla and appeared to have arisen from the wall of the fourth ventricle probably mainly in the vermis of the cerebellum. In this case, at autopsy, a nodule of tumour tissue was found in the walls of the sagittal sinus. The small darkly staining cells with little cytoplasm and round or carrot-shaped nuclei arranged in clumps or rosettes present a characteristic appearance. The tumours are often so soft that frozen sections at the time of operation may present difficulties and we have found smears as described by Russell *et alii* (1937) very useful for quick diagnosis.

Willis (1953) has described the close relation of these cells to the granular layer of the cerebellar cortex. Raaf and Kernohan (1944) have shown the persistence of these cells in the posterior medullary velum in infants from the age of 8 weeks up to 5 years. Bodian and Lawson (1953) have pointed out that in spite of rapid growth mitoses are rare and they consider that true rosette formation is also rare. They have put forward the suggestion that when such a tumour develops in the supratentorial part of the brain it tends to differentiate and grow more slowly so that it resembles an oligodendroglioma or an astrocytoma but that in the subtentorial region it grows rapidly and produces the typical malignant tumour of the cerebellum.

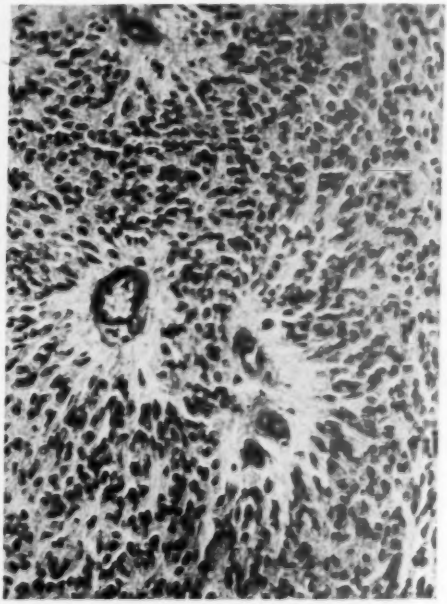

FIG. VI. Photomicrograph showing the pseudorosettes and the perivascular arrangement of the hyperchromatic nucleated cells of an ependymoma. Haematoxylin and eosin (x 200).

Willis (1953) has described the cells as occasionally arranged in drifts and this was seen in one of our adult cases (a male aged 19). This patient lived for two years after operation and X-ray therapy, which demonstrates the slightly slower progress of these tumours in adults.

Hooper (1955) considers that in some cases manifestations of the tumour occur so soon after birth that it suggests an intrauterine developmental origin. In his series of 27 cases in children under the age of 15 only one child survived more than six years.

(2) *Encapsulated tumours arising from nerves and meninges*

These tumours are grouped together because they are more accessible than the tumours of the previous group, rarely show malignant change, occur in an older age group and carry a much better prognosis.

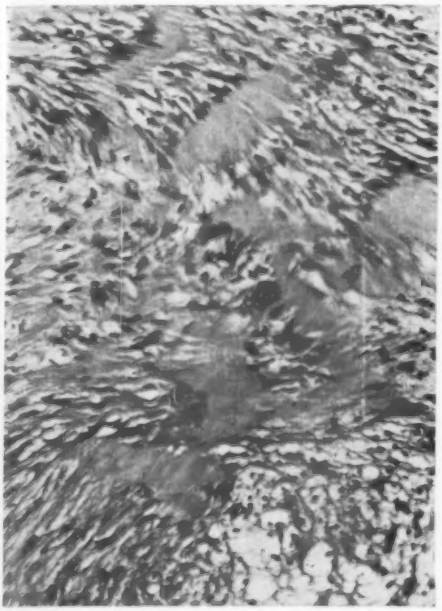

FIG. VII. Photomicrograph showing the characteristic palisading in a tumour on the eighth nerve. Haematoxylin and eosin (x 200).

(a) Encapsulated tumours arising from nerves

There were 14 cases in this group of which 4 came to autopsy. The highest age was 55, the lowest 21 with a mean of 37. There were 9 males and 5 females. The eighth cranial nerve was the site of origin in 12 cases — 3 were on the right side, 8 on the left and in one case there were bilateral tumours. In this latter case there was also a tumour on the sixth nerve, multiple cutaneous neurofibromata and a meningioma. In the other two cases there were tumours on the first and the fifth nerves.

Fig. VII is a good illustration of the typical palisading and orientation of the nuclei which makes the microscopic diagnosis of these tumours so straightforward.

Penfield (1932) quotes Henchen's statement that the sheath of the acoustic nerve stops at about 13 mm. from the brain stem. Cushing (1917) in his classical monograph has pointed out that the tumour arises in the distal part of the nerve so that portion of the tumour usually occupies the porus acousticus. Penfield (1932) believes that the tumours arise from the sheath of the nerve and calls them perineural fibroblastomata and supports Mallory in his concept that the cell type of the tumour can form fibroglia, collagen and elastic tissue. However the careful work of Masson (1932) is very convincing in its argument that these tumours arise from the sheath of Schwann and are best called Schwannomata and he believes that the Schwannian syncytium constructs endoneural collagenous material. In his discussion he is concerned with peripheral neurofibromatosis in the skin but the similarity in the histological picture between the palisading in such tumours and the intracranial ones would suggest a similar type of origin.

Gardner and Turner (1940) have reported members of a family in which bilateral acoustic tumours have been transmitted to the sixth generation. Edwards and Paterson (1951) have pointed out that the 6 out of 7 patients with bilateral tumours in their series had generalized neurofibromatosis while only 3 out of 157 patients with unilateral lesion had evidence of peripheral neurofibromatosis. The hereditary predisposition in this disease has been emphasized by Inglis (1950). In one tumour we found a large cyst containing green jelly-like material resembling the cystic type of tumour described by Baker and Bailey (1952).

(b) Meningioma

There were 27 cases of which 5 came to autopsy. The highest age was 54, the lowest 15 with a mean of 37. There was an even sex distribution with 14 males and 13 females. There was a very wide distribution of tumours —frontal, 7; occipital, 6; parietal, 2; cerebellar, 3; sphenoidal ridge, 5; parasagittal, 3; olfactory groove, 1. In one case a meningioma was associated with an eighth nerve tumour. In some cases the tumour had become so embedded in brain tissue that at first it closely resembled a tumour arising in brain tissue. The olfactory groove tumour closely resembled a Schwannoma histologically but no connection with a cranial nerve could be demonstrated.

Cushing (1922 and 1938) has discussed the view that these tumours are derived from arachnoid and not from the dura mater (which gave rise to the name dural endothelioma). What he and Weed regarded as an original observation they found on consulting the literature had been discovered already by John Cleland of Glasgow in 1864, by Charles Robin in France in 1869 and by Martin B. Schmidt of Zurich in 1902. Cushing emphasized the close relation of many of these tumours to trauma, an association which had been noted previously by Virchow. Ackerman (1953) pointed out that the cells in meningiomata are identical with the epithelial cells covering arachnoid villi and referred to the two elements in the tumour — meningo-epithelial cells and the fibrovascular stroma. Courville (1945) demonstrated the direct origin of a small syncitial or meningothelial type of meningioma from these cap cells and pointed out that ventricular meningiomata completely removed from cap cells are invariably fibrous and arise from a fibrous element.

Courville (1945), Russell (1950) and Ackerman (1953) have all given good accounts of the different histological types. In our own material we have seen cells arranged in close or loose whorls with, in some cases, calcified bodies at the centre of the whorls. These are the psammoma bodies or brain sand which were first described by Virchow (1864-65). Actually he described only this type of meningioma and the mistaken impression has persisted that these are an essential and constant finding in all meningiomata. Some of our tumours were very vascular, others syncytial and one showed a palisading of nuclei that closely resembled a neurofibroma. One tumour was very cellular with a picture that suggested malignant change. Russell (1950) has pointed out that rapid growth and malignant change can occur following repeated removal of apparently benign tumours. Jurow (1941) has reported a remarkable tumour with psammomatous metastases to the lung. In our case no metastatic deposit could be demonstrated clinically.

(3) *Pituitary and parapituitary tumours*

There were 18 tumours in this group which is smaller than the numbers of patients operated on, as satisfactory biopsy material to study was not available in all cases.

(a) Pituitary tumours (13 cases)

The highest age was 54, the lowest 14, with a mean age of 31. There were 7 males and 6 females. Eleven tumours were of the chromophobe type and 2 were eosinophil adenomata. There was cystic change in one adenoma and anaplastic change in another which contained tumour giant cells. Gilmour (1932) and King (1951) have described malignant tumours and in Gilmour's case metastatic spread had involved the liver. In our case there was no clinical evidence of metastatic spread but there was erosion of the floor of the sella turcica. There was a large eosinophil adenoma in one case which measured 5 x 3 x 2 cm.

(b) Parapituitary tumours (5 cases)

The highest age was 35, the lowest 9 with a mean age of 22. Four of the patients were females and 1 a male. In three cases the histological picture resembled the pattern of an adamantinoma and in two a squamous epithelioma with areas of calcification. Love (1950) reported on 100 cases and found X-ray evidence of calcification in 56 per cent. He considered that these tumours are the most frequent supratentorial tumours in children. King (1952) considered that the adamantinoma-like structure is the result of differentiation of epithelium in this region and is not the result of proliferation of hypophyseal residual tissue of the hypophyseal duct.

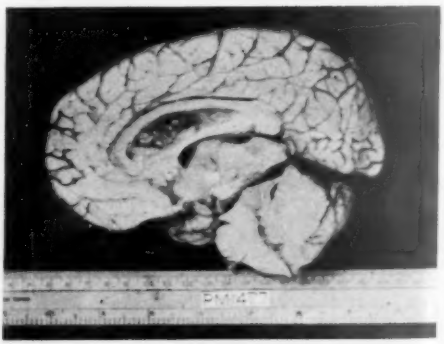

FIG. VIII. Photograph showing a pineal tumour on the posterior part of the third ventricle.

(4) *Pineal tumours*

There were three cases and they were all examined at autopsy. They all occurred in males aged 15, 22 and 31. Fig. VIII shows a tumour which measured 3 x 3 x 2.5 cms.

This tumour was in the posterior part of the third ventricle below the splenium of the corpus callosum anterior to the cerebellum and above the pons. Part of this tumour was cystic. The histological picture was very variable in different parts of the tumour. In one area the tumour consisted mainly of quite small dark cells with many interlacing fibres while in another area the large pineal cells were scattered quite sparsely through the tumour (Fig. IX). Fig. X shows a pineal tumour which completely filled the third ventricle. Fig. XI shows a tumour which almost filled the third ventricle except for a small area at the foramen of Monro. This also showed a variable pattern with some areas resembling an astrocytoma and other areas of cellularity with quite large cells present.

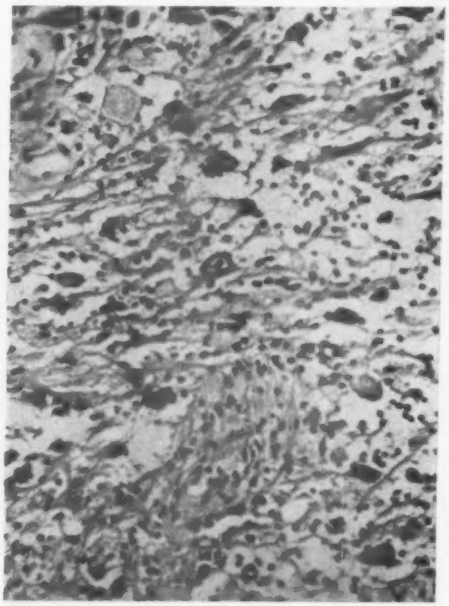

FIG. IX. Photomicrograph of an area in the tumour shown in Fig. VIII. The large pineal cells are scattered quite sparsely through the tumour. Haematoxylin and eosin (x 200).

(4) *Miscellaneous tumours* (Table 5)

(a) Colloid cyst

This was found in the third ventricle in a male patient aged 30. It had obstructed the passage of cerebrospinal fluid entering the aqueduct of Sylvius and hydrocephalus had developed. Zeitland and Lichtenstein (1937) prefer to describe these cysts as paraphyseal cysts, since the paraphyseal arch gives rise to the choroid plexus in the lateral and third ventricles. The cysts are attached to the choroid plexus of the roof of the third ventricle. By blockage of the foramen of Monro they may lead to sudden death. The cyst in this series was lined by ciliated epithelium.

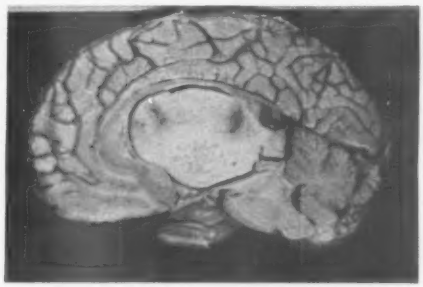

FIG. X. Photograph showing a pineal tumour which completely filled the third ventricle.

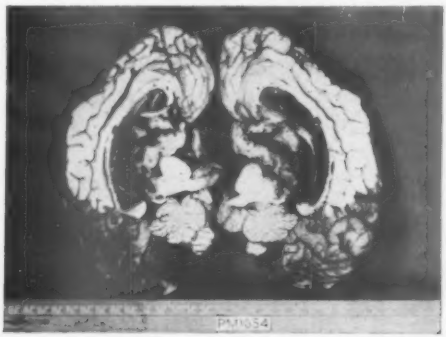

FIG. XI. Photograph showing a pineal tumour which almost filled the third ventricle except for a small area at the foramen of Monro.

(b) Cyst of the corpus callosum

This was found in a child aged 8 years and was the only lesion found in the brain at autopsy. The patient complained of abdominal pain, got out of bed, became unconscious and rigid and died some hours later. The cyst was 3 cm. in diameter, contained clear fluid and was lined by a single layer of cuboidal cells. Dandy (1931) reported two cases of this kind and considered that they develop in the cavum septi pellucidi (the so-called fifth ventricle). Hughes *et alii* (1955) have shown that a slit-like space was present in the septum pellucidum in 85 per cent. of 110 consecutive

brains. Occasionally a cyst was present. The lining cells in their series resembled ependymal cells but lacked cilia and blepharoblasts.

TABLE 5

MISCELLANEOUS CONDITIONS

Colloid cyst	1
Cyst corpus callosum	1
Dermoid and epidermoid cysts	5
Haemangiomata	4
Chordoma	1

(c) Dermoid and epidermoid cysts

(i) Dermoid cyst

This was found in a man aged 28, who had complained of severe and continuous headache for four months. At the time that the ventriculogram was done the cerebrospinal fluid was found to be quite milky with drops of oily material. This stained with Sudan III and lipoid crystals could be seen with polarized light; 35 cc. of this cerebrospinal fluid contained 4.0 g. of lipoid material. At autopsy a cystic tumour was found in the anterior portion of the right middle fossa (Fig. XII). When it was removed it weighed 35 g. and measured 4 x 4 x 3 cm. When opened, it contained sebaceous material and hair. There were a number of subarachnoid collections of lipoid material scattered over the cortex measuring 1-10 mm. in diameter. The cyst was lined by stratified squamous epithelium and its wall contained many sebaceous glands. At one point there was a foreign body reaction suggesting the point of rupture by which the sebaceous material had gained access to the subarachnoid space. The collections of lipoid material in the subarachnoid space were surrounded by a similar foreign body reaction.

(ii) Epidermoid cysts

There were 4 in the series. Two were in the region of the cerebellum, one in the third ventricle and the fourth in the pineal body region. The tumour in the third ventricle consisted of an irregularly calcified mass. The patient was aged 30 and had complained of fits resulting in unconsciousness for the past five years. No epithelial tissue could be demonstrated but we considered that this was probably a calcified epidermoid. The tumour which was removed from the pineal region by the transcallosal approach, was a cyst lined by flattened stratified squamous epithelium. The cyst contained flaky eosinophil-coloured material and laminated keratin. The cerebellar tumours were typical cholesteatomata.

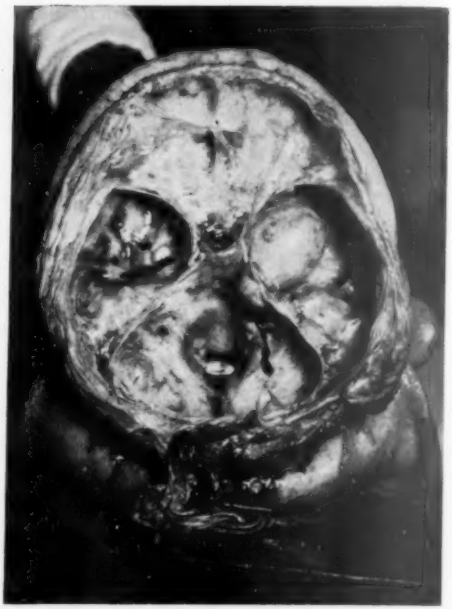

FIG. XII. Photograph of a large dermoid cyst in the anterior part of the right middle fossa which measured 4 x 4 x 3 cms. and weighed 35 g.

Ackerman (1953) points out that these cysts are really inclusion cysts and are not true neoplasms. He states that 1 per cent. of all central nervous system tumours are of this type. The pineal region in the early embryo is at the apex of the cephalic flexure and as a result is in a position immediately below the ectoderm. The term dermoid cyst, in contradistinction to epidermoid cyst, is used when the outer layer of fibrous tissue surrounding the squamous epithelium contains sweat or sebaceous glands and hair follicles. He mentions the foreign body reaction that may follow escape of cyst contents and the acute meningeal reaction that develops with rupture into the cerebrospinal fluid. Logue and Till (1952) point out that supratentorial cysts do not usually have a primary skin attachment while subtentorial cysts usually do when the cyst is extradural but

this may be lost in the intradural cyst. Miller (1950) has reported the rupture of a dermoid cyst into the lateral ventricle with a fatal outcome in which there are similar features to those seen in our case.

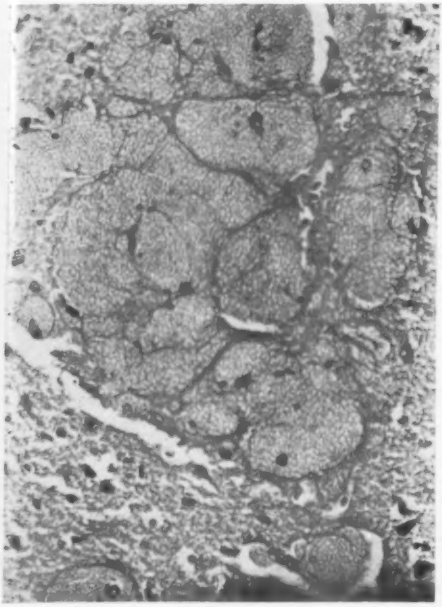

FIG. XIII. Photomicrograph showing the big cavernous spaces in a haemangioma. Haematoxylin and eosin (x 200).

(d) Haemangiomata

Three of the 4 cases were found in the cerebellum while the fourth was in the pituitary fossa region. The highest age was 40, the lowest 21 and the mean age was 32. They all occurred in male patients.

Three were histologically of the haemangioblastoma type and one a simple haemangioma. Fig. XIII is a typical example of the big cavenous spaces filled with blood which are seen in sections of this later type. This condition is best regarded as a hamartoma or developmental error and not as a true neoplasm.

(c) Chordoma

One male patient aged 32 had a chordoma in the sella region.

(5) *Secondary invasion* (Table 6)

There were 12 cases in this group. Most of these were due to invasion of the brain from tumours in the neighbourhood. In the retinoblastoma group the highest age was 8, the lowest 3 and the mean 4-4/5ths. This is a very active malignant tumour of the eye in childhood which, in some cases, extends through the optic foramen along the optic nerve and produces deposits both on the outside and the inside of the brain (Figs. XIV, XV and XVI).

TABLE 6

SECONDARY INVASION OF THE BRAIN

Retinoblastoma	5
Paranasal fibrous dysplasia	1
Carcinoma of the orbit	1
Carcinoma of nasal sinuses	2
Carcinoma of lacrymal gland	1
Carcinoma of lung	1
Carcinoma with unidentified primary (biopsy specimen)	1

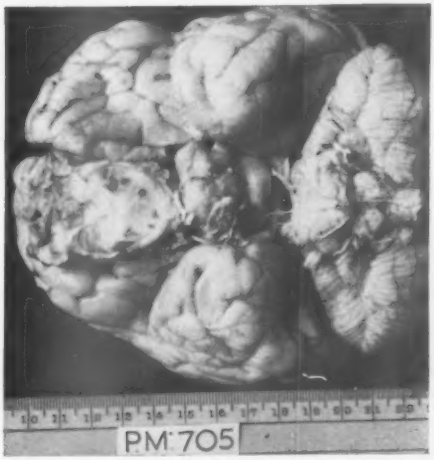

FIG. XIV. Photograph of a retinoblastoma in which the orbital contents have been removed with the brain. The tumour has extended along the optic nerve.

The paucity of blood-born secondaries in this series is remarkable but may be accounted for partly by the relatively low incidence of lung carcinoma which the thoracic unit of our hospital has encountered.

INFECTIVE CONDITIONS OF THE BRAIN

Since tuberculomata and cysticercosis (the cystic stage of taenia solium) produce tumour-like syndromes and are not uncommon in India, a note of their frequency is added. An analysis of all the space occupying lesions found at biopsy or autopsy showed that 19 per cent. of the lesions came under this category. There were 27 tuberculomata, one case of torulosis and 7 cases of cysticercosis. The mean age of the patients with tuberculomata was 16 and they were found in the situations indicated in Table 7.

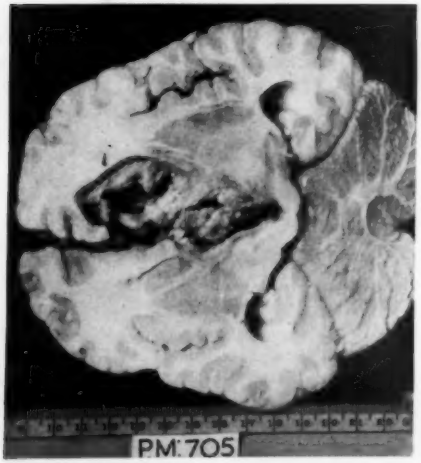

FIG. XV. Photograph shows the extension of a retinoblastoma into the brain.

FIG. XVI. Photograph shows the intraventricular extension of tumour tissue from a retinoblastoma.

TABLE 7

SITUATION OF TUBERCULOMATA OF THE BRAIN

Cerebellar	16
Frontal	2
Frontoparietal	4
Parietal	2
Temporal	1
Occipital	4
Thalamic	2

In three cases the tuberculomata were multiple. These figures indicate that when a patient under the age of twenty presents with cerebellar symptoms the possible diagnosis of tuberculoma should be seriously entertained. The high percentage of tuberculomata found in our material is about equal to that found in England and America before adequate anti-tuberculosis measures were adopted and the incidence is closely linked with the general incidence of tuberculosis in the community. The average size of the tuberculomata in our series was 5 cm.

SUMMARY

(1) One hundred and fifty-seven consecutive intracranial tumours encountered at the Christian Medical College, Vellore, South India, have been studied and classified.

(2) The history of the classification of the glioma group has been discussed and the relation of astrocytoma and glioblastoma in terms of age, site and sex has been analyzed. It is considered that the type of a tumour is related to its life history.

(3) The incidence of the types of tumour in this series has been found comparable with the series of other countries.

(4) Rupture of a dermoid cyst with subarachnoid patchy foreign body reaction is reported.

(5) The incidence of space occupying lesions due to tuberculomata torulosis and cysticercosis is found to be high. This is related to the general incidence of such infections in India.

ACKNOWLEDGEMENTS

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INFECTION AND GANGRENE IN THE FOOT OF DIABETIC PATIENTS: THE VIRTUES OF CONSERVATISM

By Ewen Downie and Maida O'Connor

Diabetic and Metabolic Unit, Alfred Hospital, Melbourne

INFECTION or gangrene occurring in the foot of a middle aged or elderly diabetic patient presents problems in management which differ from those encountered in younger people. There are several reasons for this. There is usually an impairment of blood supply which is insidious in onset, slow in development and often symptomless; there is an insensitivity of the foot due to peripheral neuritis which allows injury to skin and soft tissues to occur from negligible trauma, oftimes without the patient knowing it has happened. It must not be forgotten that these changes in vascularity and sensation are seldom confined to one leg. When confronted with spreading infection or gangrene in one extremity it is well to remember that the unaffected limb of today may be the site of even more serious trouble in the future. Thus, every effort should be made to conserve the leg or the foot, as a crutch or an artificial limb is an inadequate and precarious substitute in an old person. A fall from loss of balance and the patient loses confidence and prefers to spend the rest of his life confined to a wheel chair.

Radical amputation of the leg should be reserved for those cases in which overwhelming infection threatens life, or where infection, progressing beyond the anatomical confines of the foot, has become impossible to control; for those cases in which tissue destruction from gangrene is so extensive as to make any workable restoration of the foot impossible, and for those rare cases in which prolonged, persistent and intractable pain demands relief. In all other cases every effort should be made to provide the patient with an animated stump, no matter how grotesque, for we know of no substitute as effective in an elderly person.

Obviously, conservative care of the diabetic foot is a matter of prevention of injury and of infection. Education of the patient in the care of his feet should include instruction in washing and drying, in the avoidance of the local application of heat in any form, in the avoidance of ill fitting shoes and darned socks, insistence upon scrupulous care when cutting toe nails and calluses and in the avoidance of desquamating corn cures. Skilled chiropody plays a large part in this and no elderly patient with failing vision should attempt to pare his toe nails or his corns.

FIG. I. Patient before fitting of prosthesis.

A trivial and insignificant injury often serves as the portal of entry for infection; the

resulting processes of inflammation, including the elaboration of H substance, further jeopardize the vascularity of an area already impoverished of blood. In consequence, tissue damage proceeds to tissue death and gangrene slowly extends until an equilibrium is established in an area of scarcely adequate blood supply. Infection is often caused by organisms of low grade virulence. In such instances, the use of broad band antibiotic ointments containing bacitracin, neomycin or other similar drugs is often of value. If applied early, infection may be controlled and overcome before serious tissue damage occurs.

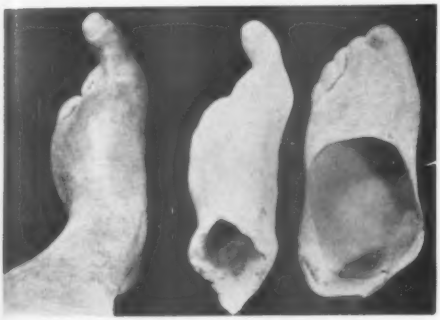

FIG. II. Stump of foot, cast and slipper prosthesis.

If neglected or if a more virulent infection occurs, there is a likelihood of spread into the tissues of the foot along the paths of the tendon sheaths. When this occurs on the dorsum of the foot, the course and extent are usually quite obvious, but infection tracking in the sole travels deep below the plantar fascia and gives no external evidence of its presence until considerable damage has been done. On occasions X-ray examination may reveal entirely unsuspected osteomyelitis of a phalanx or a metatarsal bone.

It is surprising that the accepted surgical principles of treatment of infection, namely adequate incision, adequate drainage and debridement of dead tissue, are not applied to such problems as often or as thoroughly as they are in other situations. Wide incision along the sole of the foot with appropriate exposure and removal of dead tissue should be followed by the continuous local application of an appropriate antibiotic drug delivered into the wound through a fine perforated polythene tube. In these days, appropriate laboratory assessment of the organisms allows the use of an antibiotic of known efficacy against most infections. It is quite useless to expect the parenteral use of antibiotics to be as efficient for the simple reason that the blood supply to the foot is usually so poor as to prevent any possibility of an effective concentration of drug at the site of the infection.

As a consequence of these conservative measures one is often confronted at a later stage with a foot minus one or more toes,

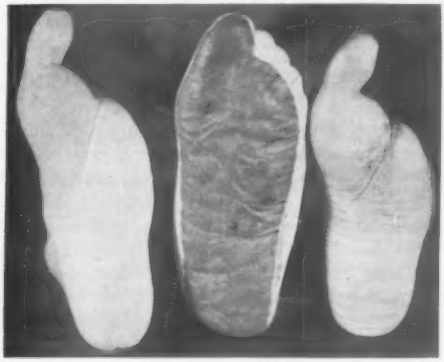

FIG. III. Stump of foot, cast and slipper prosthesis (plantar view).

with a transmetatarsal amputation or with a foot distorted in some other fashion. When healing has occurred the predisposing factors of poor vascularity and insensitivity remain. There is little use in providing a patient with a stump of foot unless appropriate means exist to prevent further trauma to this vulnerable tissue. Indeed it may be asked whether, in view of this, it is worth while trying to be conservative. The answer is that experience has taught us that such stumps can and do serve patients satisfactorily for many years.

The problems of the stump have been overcome by the fitting of a slipper prosthesis. This device, with certain modifications of shoes or boots, has made it possible to get these patients back on their feet walking quite satisfactorily.

A negative cast is made of both feet with Gipsona bandages and from this positive casts are obtained. The normal foot is cast to serve as a guide for measuring the length and depth and shape of the prosthesis.

The cast of the affected foot is covered with chamois leather which is stretched on firmly and pinned into position to form four seams. The surplus chamois is then cut away leaving about a ½ inch seam. The pins are removed from one seam at a time, the leather flattened out and rubber solution brushed on, this is allowed to dry for a few minutes before pressing the two edges together. When all the seams have been treated they are cut level with the cast and pressed flat. The seams are next sealed with layers of gauze one inch wide which prevents splitting of the chamois lining. A double layer of gauze is pulled firmly round the throat of the cast to prevent stretching.

Layers of latex foam or compressed felt are then covered with solution and placed over any possible pressure points and skived to the contours of the cast. Then layers of latex foam are added with the use of solution until the prosthesis approximates the size of the normal foot. This is then allowed to dry for at least eight hours before the final shaping. This consists of cutting away the surplus rubber and skiving the prosthesis to the contours and measurements of the normal foot.

Finally an outer layer of skiva skin, usually soft kid, is cut into a double U shape and smoothed on over the mould with solution leaving one seam at the back of the heel which is sealed with a small piece of leather. The surplus leather under the toes is cut away and the whole finished with a leather sole covering.

The fitting and adjusting of shoes and boots for these patients is most important. It has been found necessary to build them up considerably in order to overcome the imbalance which results from the loss of toes or a greater part of the foot as medial rotation and eversion is inevitable. This has been overcome by the use of Thomas heels with an inner buttress of up to ¼ inch and by the fitting of a domed metatarsal bar or a convex rocker bar.

The convex bar is built up from ½ inch at the base of the heel and is carried forward to the normal position of the metatarsal heads where it is brought level with the sole of the shoe. The Derby design of boots and shoes has been found the most suitable for these adjustments which help to carry the body weight through the tarsal area. This gives the patient confidence and allows him to walk with a much freer gait. When first using the prosthesis with a modified shoe or boot the patient is placed in a walking machine and taught to walk with a rocking movement initiated at the knee joint. He soon learns this manœuvre and can progress quite satisfactorily without the aid of a crutch or stick.

FIG. IV. Final result.

The following case history exemplifies a typical application of this technique.

Case 1

A man aged 63 years was admitted to the Alfred Hospital in 1952 suffering with cellulitis of the left foot and an infected gangrene of the second toe.

Twelve months before, a mid-thigh amputation had been performed elsewhere for diabetic gangrene of the right foot. With conservative measures the infection in the left foot subsided and amputation of the second toe was performed six weeks after his admission. Soon after, he showed unmistakable evidence of spread of infection into the sole of the foot with involvement of the plantar fascia. In a desperate attempt to save the foot, extensive incision with adequate debridement was performed and continuous instillation of antibiotics directly into the affected area was commenced. The infection gradually subsided within the next three months. It was then possible to perform a further conservative operation. The third, fourth and fifth toes were removed with portions of the corresponding metatarsal bones. The great toe, which was unaffected, was left, as it was thought that in a man with only one leg it would lend stability to the stump which would have great responsibility for weight bearing. After ten months in hospital the left foot was soundly healed. A slipper prosthesis was made with a glove-like compartment for the great toe, and the metatarsal area was laminated with a layer of ¼ inch latex and compressed felt added to give more firmness in the longitudinal arch. An artificial limb was fitted to the mid-thigh stump of the right leg and ordinary shoes were fitted to both feet. It was thought that any form of bar on the left shoe would prove difficult to manage. At the time of his discharge from hospital this man was walking surprisingly well with the aid of one stick. A few months later he suffered a cerebral thrombosis with hemiplegia and died soon afterwards.

ACKNOWLEDGEMENT

It is desired to express our thanks to Mr. H. Anthony Phillips, F.R.C.S., who has not only operated on our patients but has also given much stimulating criticism and helpful advice.

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BILIARY SURGERY IN CHLORPROMAZINE JAUNDICE

By J. T. Duhig

Brisbane

CHLORPROMAZINE (Largactil) is being more and more widely used in medicine and its use is well known in the treatment of the psychoses and psychoneurotic disorders (Morgan, 1956), in anaesthesia and as an antiemetic and analgesic. It is now well recognized that administration of the drug may be followed by several undesirable side effects, of which one of the most frequently reported is a jaundice of obstructive type. However, certain other side effects, though less prominent, may be of equally serious import and those reported include an increased tendency to bleeding (Giacobini and Lassenius, 1954), non-thrombocytopenic purpura (Marley, 1955), agranulocytosis and leucopenia (Lomas *et alii*, 1955; Adams *et alii*, 1956; Bernhard *et alii*, 1956) and, in vitro, a delayed clotting effect on blood has been demonstrated by Courvoisier, *et alii* (1953). These side effects, while undesirable in any patient, are especially so when patients suffering this particular form of jaundice, may have to undergo major surgery and the following case illustrates what appears to be a not infrequent problem in the management of those patients who develop jaundice during chlorpromazine therapy. The jaundice induced by chlorpromazine appears obstructive in type but the obstruction to bile flow is intrahepatic and in its relief, laparotomy is probably contraindicated. How, then, may this condition be distinguished from the case of extrahepatic biliary obstruction in which surgery is demanded for its cure?

Case Report

A female, aged 61, was admitted to hospital, suffering from jaundice of some four weeks duration. During this time, she had been nursed at home, where she had been attended by her family practitioner. Throughout this period, the jaundice had gradually increased, although just prior to admission it was thought that, clinically, there had been some lessening of the pigmentation. This jaundice appeared obstructive in type with marked bilirubinuria and acholic stools. Her admission to hospital had been recommended by a consultant surgeon, who considered that laparatomy should be performed to exclude the presence of biliary calculi or malignancy obstructing the outflow of bile. The patient was a nervous apprehensive woman, who had suffered a fairly severe psychological upset following the death of her husband, some months before. She had refused to eat and had to be coaxed into taking nourishment. For some time she had existed on a substandard diet which had resulted in some obvious weight loss, but this change was difficult to evaluate owing to the patient's mental state. The biochemical tests on admission showed what appeared to be the picture of extrahepatic obstructive jaundice (Table 1).

At laparotomy, however, there was no evidence of blockage to the common bile duct and no calculi or malignant growths were found in relation to the biliary system despite careful search. Post-operatively, it was ascertained that the patient had been treated for her psychological state with chlorpromazine for approximately one month before the onset of jaundice. During this time she had received 25 mgm. of the drug, three times daily for two weeks and then 25 mgm. twice daily, for a further two weeks, when jaundice appeared quite suddenly and quite silently. There had been no prodromal symptoms. The drug was stopped and she was observed at home as was mentioned previously.

During the post-operative period the patient's jaundice continued to improve, while the biochemical findings still appeared to indicate the classic common bile duct obstruction. It was obvious, however (see below), that this was a case of chlorpromazine induced jaundice.

Interesting features of the laboratory findings were the altered prothrombin time, the lowered serum protein level and later the abnormal serum electrophoretic pattern. Prothrombin times and total serum protein levels when performed in these cases have usually been within normal limits, and while altered serum protein levels have been observed, alterations in the particular protein fractions have not been frequently noted. A table summarizing the laboratory findings is appended (Table 1) and the electrophoretic pattern is seen in Fig. 1.

The patient's post-operative course was not smooth. She developed some local wound sepsis on the tenth post-operative day and a small biliary fistula persisted. She was readmitted to hospital for closure of this fistula, thirty-seven days after her original institutional visit. This was satisfactorily carried out only to see her suddenly become collapsed and pulseless, three days after operation. An electrocardiograph taken at this time showed an anterior myocardial infarction with left bundle branch block. She died quite rapidly. Permission for autopsy was refused on religious grounds. The total duration of the illness was ten weeks.

TABLE I

Date	Hb. gms. per cent.	Leucocyte Count per cu. mm. and differential	Serum Protein gms. per cent.	Serum Bilirubin mgms. per cent.	Cephalin-Cholesterol Floce. Test 24 and 48 hrs.	Serum Alkaline Phosphatase K.A. Units	Prothrombin Time — secs. Control ( )	Urine	Faeces	Remarks
1st Admission 3rd July, 1956	11.7	8,300 N. 51 per cent. L. 40 per cent. M. 9 per cent.	5.8	10	Negative	28	19 (15)	Bile +++	Pale	Prothrombin time—one stage test All bilirubin estimations showed mainly direct reaction
5th July, 1956	Operation—Transfusion before and during of 1¼ litres whole blood + 25 gms. albumin									
7th July, 1956	14.2		6.9	8.4	Negative	20		Bile +++	Pale	
10th July, 1956			6.8 Electrophoretic pattern α_1 and α_2 fractions increased	7.4	Negative 24 hrs. + 1 48 hrs.	16		Bile ++	Pigmented	Electrophoretic pattern 200 V. for 3 hrs.
16th July, 1956	13.5	17,300 N. 73 per cent. L. 21 per cent. M. 7 per cent.		7.1	Negative 24 hrs. + 1 48 hrs.			Bile ++	Pigmented	
18th July, 1956			6.4	7.0						
31st July, 1956		5,000 N. 64 per cent. L. 27 per cent. M. 7 per cent. E. 2 per cent.		3.8	Negative	15.7		Bile +	Pigmented	
2nd Admission 10th August, 1956	14.4		5.9	4.6			31 (21)			I.M. Vitamin K given
13th August, 1956							22 (22)			I.M. Vitamin K given
14th August, 1956	Operation									
17th August, 1956	Died									E.C.G. Ant. Myo. Infarct + L.B.B.B.

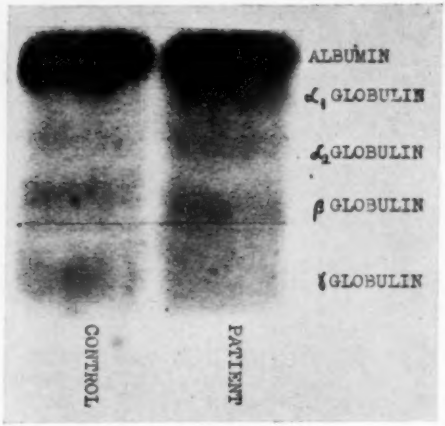

FIG. I. Serum paper electrophoresis. Note increase in α_1 and α_2 globulins.

COMMENT

This case, in its clinical and biochemical aspects, would appear to follow fairly closely the now familiar picture of chlorpromazine induced jaundice. There are, however, several features about the case and the condition itself which merit comment.

It is now well established that the administration of chlorpromazine may be followed in a small, but definite, number of cases by a jaundice of obstructive type (Isaacs *et alii* 1955; Lomas *et alii* 1955). This case was considered to be one of chlorpromazine jaundice for the following reasons. At the time when the jaundice occurred, there was no epidemic of infective hepatitis flourishing in the community and there were no similar cases of jaundice in the patient's relatives or friends. There was no history of an injection being given in the six months prior to the onset of jaundice and there was no history or evidence of exposure to any hepatotoxic agent in the few weeks preceding the appearance of the jaundice, other than the chlorpromazine. There were no symptoms of illness, such as are seen in hepatitis of infective origin and laparotomy revealed no extrahepatic obstruction in the biliary system, while the clinical and biochemical findings pointed to a lesion of this nature. Further, the jaundice appeared to be lessening preoperatively and this it certainly did post-operatively (Table 1), although no extrahepatic biliary block had been removed. It was concluded that the chlorpromazine was the precipitating agent in the production of the jaundice in this case.

The pathogenesis of this condition remains obscure and there have been numerous papers published discussing this problem, while several theories as to the causation of the jaundice have been advanced. On the basis of raised eosinophil counts which have been seen in a certain number of the cases, it has been suggested that there is an allergic background to this liver disorder (Hartnett, 1955; Lemire and Mitchell, 1955; Van Ommen and Brown, 1955). It is true that allergic skin rashes and purpura do occur during the administration of the drug (Morgan, 1956), but they have not usually been associated with jaundice. Indeed, it has been shown that readministration of the drug after subsidence of the jaundice does not result in its reappearance (Cohen and Archer, 1955; Isaacs *et alii* 1955). Generally, the allergic hypothesis remains unproven, but it is interesting to note that A.C.T.H. and cortisone appear to influence the course of the disease (Grytting, 1954; Stein and Wright, 1956). In this case, there was never at any time an eosinophilia and total and differential white cell counts remained normal throughout the illness, apart from a transient neutrophilia in response to infection.

The low serum protein which was found in this patient initially, was probably a reflection of her nutritional state and it was considered an unlikely factor in the pathogenesis of the jaundice, as the majority of reported cases have had serum protein levels within the normal range (Lemire and Mitchell, 1955; Van Ommen and Brown, 1955). While Isaacs *et alii* (1955) advance cogent reasons for considering that the action of chlorpromazine is not a direct toxic one on the liver cell, they consider that previous liver damage is a contraindication to chlorpromazine therapy and it probably should not be given to patients suffering dietary deficiency. Boardman (1954) has reported a death considered due to chlorpromazine jaundice in a patient with chronic passive venous congestion of the liver and death has also been reported in a patient suffering from delirium tremens and cirrhosis of the liver (Editorial *Brit. med. J.*, 1954).

That age would appear to be an important factor is seen from the fact that of 38 documented cases available to me, and including

this one, 29 were over forty years of age (Boardman, 1954; Chesney, 1954; Zatuchni and Miller, 1954; Hartnett, 1955; Isaacs *et alii*, 1955; Lemire and Mitchell, 1955; Loftus *et alii*, 1955; Movitt *et alii*, 1955; Van Ommen and Brown, 1955; Cohen and Archer, 1956; Lindsay and Skahen, 1956; Morgan, 1956; Murphy and Ofner, 1956; Stein and Wright, 1956). The sexes were evenly represented, there being nineteen males and nineteen females.

Further interesting avenues of approach to the problem of the pathogenesis of this condition are seen in the work of Laborit (1954), who has shown that the drug probably has a depressant effect on the hypothalmic nuclei and of Mosinger (1952), who has shown that damage to the hypothalamic area may produce disfunction in the liver, kidneys, heart and lungs.

Lastly, an interesting hypothesis has been advanced by Stein and Wright (1956), who noted marked improvement in the condition of one of their cases following the administration of cortisone. They liken the phenomenon of chlorpromazine jaundice to that of the inspissated bile syndrome in children and they postulate that the effect of cortisone is to reduce the viscosity of the bile and so allow it to pass from the small biliary channels, where biopsies have shown stasis to be occurring, into the larger ducts and thus relieve the jaundice. A similar effect has been reported by MacPhee (1956) in cases of chronic biliary cirrhosis. It may be noted that Egdahl and Richards (1956) have shown that administration of chlorpromazine increases A.C.T.H. secretion in the dog. Can it be that a cortisone depletion or A.C.T.H. blocking mechanism operates in these cases?

Of the cases reported to date, almost all have presented with an obstructive type of jaundice, as was the case here, and the biochemical findings in blood, urine and faeces have all tended to support a diagnosis of extrahepatic obstruction to the biliary flow (Table 1). For this reason, added to the fact that the majority of the sufferers are elderly, many of the patients have undergone laparotomy, in order to exclude the possibility of biliary or pancreatic malignancy or biliary calculus. Thus of the 38 cases mentioned above, 10 or just over one quarter, underwent laparotomy. In none of the patients was an extrahepatic biliary block disclosed and the majority proceeded to uneventful recovery, which has been the usual course with the greater number of recorded cases, whether undergoing surgery or not. In the present case, no extrahepatic biliary obstruction was found at operation and the nature of the jaundice was not appreciated until the postoperative period, when it became known that the patient had received chlorpromazine therapy. The position in reference to surgery in these cases, may be complicated by the fact that some of these patients may present evidence of frank or suspect biliary tract disease, e.g. Case 3 of Isaacs *et alii*, Case 1 Movitt *et alii*, Case 3 of Lemire and Mitchell and Case 4 of Lindsay and Skahen. It is known that surgery is contra-indicated in hepatitis of infective origin and this may also be the most desirable course in the "cholangiolitic" type of hepatitis (Lancet, Annotation, 1956; MacPhee, 1956). In chlorpromazine jaundice, however, it would seem that surgery is definitely contra-indicated, for while liver disfunction is one of the side effects of chlorpromazine therapy, other undesirable reactions occur in patients so treated.

These adverse effects of the drug have been mentioned previously and they include increased tendency to bleeding, purpura, agranulocytosis (this by many authors) and *in vitro*, an anticoagulant effect on blood. All these have been described in relation to chlorpromazine therapy and they constitute most undesirable reactions in patients who may be undergoing abdominal laparotomy. It should also be remembered that certain cases have progressed to liver failure and death (Boardman, 1954; Murphy and Ofner, 1956) and it must surely be desirable to avoid surgery in these cases. Further, consideration must be given to the fact that operation has not been shown to affect beneficially the course of the jaundice following chlorpromazine therapy, while the certain degree of morbidity from biliary tract exploration is added to the patient's illness.

How, then, in the face of persistent obstructive jaundice, in the patient in the older age group, may operation be avoided? How can the surgeon be certain, even armed with the history of chlorpromazine therapy, that there is no abdominal malignancy present, or a silent biliary calculus is not present, which radiography does not visualize?

Lemire and Mitchell (1955) state that a history of some prodromal symptoms, fever and the occurrence of eosinophilia, help one to distinguish this condition from the case requiring surgical intervention and similar views have been advanced by other authors (Hartnett, 1955; Van Ommen and Brown, 1955). However, in the majority of recorded cases, many or all of these features have been lacking, which was the case with this patient; and while they should be looked for, they provide no sound basis for diagnosis.

Radiography, of course, must be used to exclude radio-opaque biliary calculi, but negative results will not exclude the presence of a calculus or malignancy, while appearances suggestive of the presence of calculi may actually lead to laparotomy, e.g. Case 4 of Lindsay and Skahen and Case 1 of Movitt *et alii* (1955).

At the present time, the pathology of the liver in chlorpromazine jaundice has not been extensively studied, largely due to the essentially benign nature of the condition. However, several papers have now appeared in which material for histological study has become available in a number of ways. Biopsy material from the liver has been obtained at laparotomy (Lemire and Mitchell, 1955; Van Ommen and Brown, 1955) and by needle puncture (Hartnett, 1955; Loftus *et alii*, 1955; Movitt *et alii*, 1955; Lindsay and Skahen, 1956) and the histology of the liver has been studied in patients dying from coincidental disease (Isaacs *et alii*, 1955; Stein and Wright, 1956) and in those patients who have died from the disease itself (Boardman, 1954; Murphy and Ofner, 1956). The lesions described resemble those of the so-called cholangiolitic hepatitis (Watson and Hofbauer, 1946; Goulston and Smith, 1951) or what MacPhee (1956) has named the preliminary stage of primary biliary cirrhosis. Microscopically, these lesions show plugging of the intralobular bile capillaries by bile thrombi, the changes being most marked about the central veins. There are also some centrilobular, intracellular bile plugs seen, with some cellular infiltration of the portal tracts. No bile stasis, apart from that mentioned above, is seen and the bile ducts in the portal areas are not dilated. Cellular infiltration of the portal tracts appears to be minimal in the recovered cases and they show little or no hepatic cellular damage. The fatal cases have shown liver cell damage to be more marked but this is not a prominent feature of the disease (Murphy and Ofner, 1956). These changes then, when carefully considered, do not resemble the pattern seen in extrahepatic obstructive jaundice, especially when the condition may have been present for some time, and they allow of differentiation between diseases of primarily intrahepatic origin and those due to extrahepatic lesions.

It would appear that the one really reliable procedure, making possible pre-operative differentiation of intrahepatic and extrahepatic biliary obstruction, is histological examination of the affected liver tissue. In order to obtain this, prior to laparotomy, recourse must obviously be had to puncture biopsy of the liver. In the past, this procedure has not been without its critics, but King (1952) reports 500 consecutive biopsies without fatality from the Royal Melbourne Hospital and Lichtman (1953) quotes a large survey in which the mortality rate was 0.12 per cent. of 10,600 biopsies, a figure which compares more than favourably with those for common bile duct exploration (Maingot, 1955). Lichtman also states that the clinical diagnosis of obstructive jaundice is improved in accuracy by 20.6 per cent. with the use of puncture biopsy. The procedure is now being widely used and it has been used quite successfully to date in studying these cases of chlorpromazine jaundice (Lindsay and Skahen, 1956). It is therefore suggested that all cases who present with a jaundice of this type, who give a history of chlorpromazine therapy (and it is essential to enquire specifically for this, as patients with psychiatric disorders under treatment may not volunteer the information) should have a puncture biopsy of the liver performed before laparotomy is undertaken. The resulting tissue should then be examined for lesions of the type described above. If this procedure is adopted, then knowledge of the pathology of this condition may be more quickly acquired and exact preoperative diagnosis made with certainty in a greater number of cases, while unnecessary laparotomy, with the attendant risks of other side effects of chlorpromazine being present, may be prevented. Also in this way case morbidity from biliary tract exploration would be avoided, with added benefit to the patient.

It is further suggested that, in cases of prolonged jaundice, where biopsy still leaves some doubt, treatment with A.C.T.H. or cortisone should be tried. Certain cases of chlorpromazine induced jaundice and allied liver disfunctions have responded dramatically to this therapy (Johnson and Doenges, 1956; MacPhee, 1956; Stein and Wright, 1956), thus removing the need for laparotomy in those who so re-act.

SUMMARY

1. A case of chlorpromazine induced jaundice is described together with the laboratory findings.

2. The literature relating to the etiology and pathogenesis of the condition is briefly reviewed.

3. Reasons are advanced for attempting to avoid surgery in these cases.

4. It is suggested that puncture biopsy of the liver be performed in order to obtain this end.

5. It is further suggested that in prolonged jaundice treatment with A.C.T.H. or cortisone be instituted.

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PRIMARY PERITONITIS

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PRIMARY peritonitis is a disease with a puzzling pathogenesis and a high mortality, occurring infrequently in children and even more rarely in adults. Accordingly most published reports have dealt with only small series of cases and no agreement has yet been reached regarding the correct lines of treatment or the relative merits of surgical and non-surgical procedures.

Since few individuals could have had much personal experience with this uncommon malady and since it is predominantly a disease of childhood, the aggregate of experience of any large paediatric hospital should be a suitable guide to rational therapy. Up to date the most detailed information of this sort is that of Gross (1953) who reported, from the Children's Hospital, Boston, a combined group of 158 cases of peritonitis which included cases not only of primary peritonitis, but also of peritonitis secondary to some focus of infection outside the abdominal cavity.

The present report is based on ninety-seven cases of primary peritonitis, with no discernible source of the infection elsewhere in the body, admitted to the Royal Children's Hospital, Melbourne, during the past thirty years.

This review is intended chiefly to emphasize how much the antibiotics have reduced the fearful mortality of former years. It also challenges some widely accepted views on the value of peritoneal drainage and the risks of concurrent appendicectomy. It was prompted by personal experience during the past twelve months of three cases of primary peritonitis treated at this Hospital. Since these three exhibited many of the common features of the present-day natural history of the disease their case records form a suitable introduction to the broader study of our combined local experience.

Case Notes

Case 1

A girl aged 9 years presented with central abdominal pain of twelve hours duration. The same day she had noticed for the first time a slight vaginal discharge and one week earlier had had a "puffed up red eye" which resolved spontaneously. Physical findings were a temperature of 102.4° F, diffuse tenderness and rigidity over the lower portion of the abdomen, and a slight inoffensive muco-purulent vaginal discharge. The peritoneal cavity was opened through a right iliac muscle splitting incision and contained widespread thin odourless pus. The appendix, the bowel and the right Fallopian tube were superficially congested but were otherwise normal. The left tube and ovary felt normal. The appendix was removed and the wound was closed without drainage. No intravenous fluid therapy was required. Intramuscular penicillin and streptomycin were given post-operatively and the child made an uneventful recovery.

A swab of the peritoneal pus was sterile on culture: from the vagina B. coli, Staphylococcus albus and diphtheroid bacilli were grown. No antibiotics had been given prior to operation.

Case 2

A five year old girl presented with abdominal pain of four hours duration and a temperature of 99.2° F. The lower half of the abdomen was tender, the tenderness being located chiefly in the right iliac fossa, where there was some rigidity. The operation findings were similar to those in Case 1, and the appendix was removed through a right iliac muscle splitting incision which was closed without drainage. Rapid and uneventful recovery followed the administration of penicillin and streptomycin. Parenteral fluid therapy was unnecessary.

Pneumococci were cultivated from the peritoneal pus and from the vagina.

Case 3

A girl aged eight, with known partial liver failure following infectious hepatitis two years earlier, had had a purulent vaginal discharge for two weeks before presenting with generalised abdominal pain, diarrhoea, and vomiting of three days duration. Examination showed a desperately sick patient with a temperature of 101.6° F. and a distended, tender, rigid abdomen. After her resuscitation with serum and blood transfusions laparotomy revealed a small cirrhotic liver and a purulent general peritonitis; pus could be squeezed from the right Fallopian tube; the appendix and remaining viscera were superficially inflamed but were otherwise of normal appearance. The abdomen was closed without drainage.

Post-operative treatment with penicillin and streptomycin, gastric suction, and continuous intravenous fluids was unsuccessful and the child died three days later.

Pneumococci were grown in culture from the peritoneal pus and autopsy confirmed the diagnosis of primary pneumococcal peritonitis associated with sub-acute hepatitis.

Commentary

The usual course, as typified by the first two cases, is a rapid or even fulminating onset in a previously normal child, with symptoms and signs which cannot confidently be distinguished from those of acute appendicitis. Hence in these patients a right iliac incision is usually chosen for laparotomy, and concurrent appendicectomy is often performed. Following the exhibition of antibiotics these patients recover promptly. The mortality in this non-ascitic group is now negligible.

The last case illustrates how patients with pre-existing ascites, more commonly associated with nephrosis, are especially prone to primary peritonitis and tend to do badly in spite of modern methods of treatment.

CRITERIA FOR CASE SELECTION

In deciding upon the criteria for inclusion of a case in this series it was realised that the definition of "primary" peritonitis is somewhat arbitrary and cannot be completely divorced from a consideration of pathogenesis.

Fraser and McCartney (1922) held that only those cases in which there was no clinical focus of infection elsewhere in the body should be considered as "primary". However, it is obvious that the infection can never be "primary" in the pathological sense but is secondary to contamination of some body surface and must reach the peritoneum either by haematogenous spread, along lymphatics, directly through the bowel wall, or by ascent of the female genital tract. Only the first and last of these possibilities has ever met with much popular credence, and those who favour the haematogenous route extend the use of the term "primary" to cases of peritonitis complicating some known focus of infection outside the abdominal cavity (Ladd and Gross, 1941; Nelson, 1950; Moncrieff and Evans, 1953).

However, for the purposes of an investigation such as this, the presence of some obvious primary infection carrying a mortality of its own, such as pneumonia or erysipelas, would certainly cloud the issue with regard to the assessment of various forms of treatment. Accordingly, the already mentioned clinical definition of Fraser and McCartney (1922) was preferred here and, with one exception, only those children in whom there was no discernible source of the infection elsewhere in the body were included. The exception was a case of coincident primary peritonitis and pericarditis due to B. proteus which poses essentially the same pathological puzzle concerning the "primary" infection of serous membranes.

In all but one patient the diagnosis of peritonitis was established either by laparotomy, by autopsy, or by paracentesis. The one exception was a patient with nephrosis in whom the clinical features alone were so typical that its inclusion in the series was warranted.

INCIDENCE

Prevalence

The incidence of primary peritonitis in relation to the overall incidence of abdominal emergencies in childhood has been variously estimated at 10 per cent. (Lipshutz and Lowenburg, 1926), 7.7 per cent. (Barrington-Ward, 1937) and 2 per cent. (Fraser and McCartney, 1922). In this hospital during the past five years the frequency has averaged between only 1 and 2 per cent. of all abdominal emergencies. These emergencies, in children under 14 years of age, included at least 300 cases of acute appendicitis yearly.

It has been suggested by Brown (personal communication to Ryan, 1953) and by Gross (1953) that the now widespread use of antibiotics in the community has greatly reduced the prevalence of the disease in recent years but there has been no obvious decrease in incidence in our experience (Table 4). The position is difficult to assess since the observed increase in incidence may well be only apparent, and attributable to population increase (the average yearly admissions have slightly more than doubled in the thirty-year period considered). The reasons for the extremely small observed incidence in the 1941-1945 period are not understood.

Age and sex incidence

In infancy and the early years of life the incidence in the two sexes was about equal but, as in most other series, the peak incidence was in girls about 4 to 8 years of age (Table 1 and Fig. 1), the overall sex ratio being 3 females to 1 male.

After the first year of life 12 out of 18 male cases were patients with pre-existing ascites. After infancy it can be seen (Fig. 1) that the male incidence was largely a reflection of the age incidence of nephrosis,

of which the peak incidence of onset, as judged by the first appearance of oedema, is between 18 months and 4 years of age (Riley and Davis, 1955).

Gross (1953) quotes an equal sex ratio and an incidence of 75 per cent. of cases under 5 years of age, but as previously stated his series includes cases which in this study have been defined as secondary in origin.

TABLE 1

AGE AND SEX DISTRIBUTION OF 97 CASES OF PRIMARY PERITONITIS

Age Group (Years)	Males	Females	Total
0 - 1	7	5	12
1 - 2	2	2	4
2 - 3	1	6	7
3 - 4	5	—	5
4 - 5	—	11	11
5 - 6	1	10	11
6 - 7	1	7	8
7 - 8	2	11	13
8 - 9	2	8	10
9 - 10	2	6	3
10 - 11	2	2	4
11 - 12	—	3	8
12 - 13	—	—	—
13 - 14	—	1	1
	25	72	97

CLINICAL FEATURES

The mode of presentation in 76 cases was as an acute abdominal emergency and in 3 cases as a localised intraperitoneal abscess. In the remaining 18 patients the onset either passed unnoticed or else produced a miscellany of non-specific symptoms and signs.

Table 2 shows the frequency and nature of those accompanying diseases which may have provided a portal of entry to initiate the peritoneal infection or which may have rendered the patients more liable to such infection.

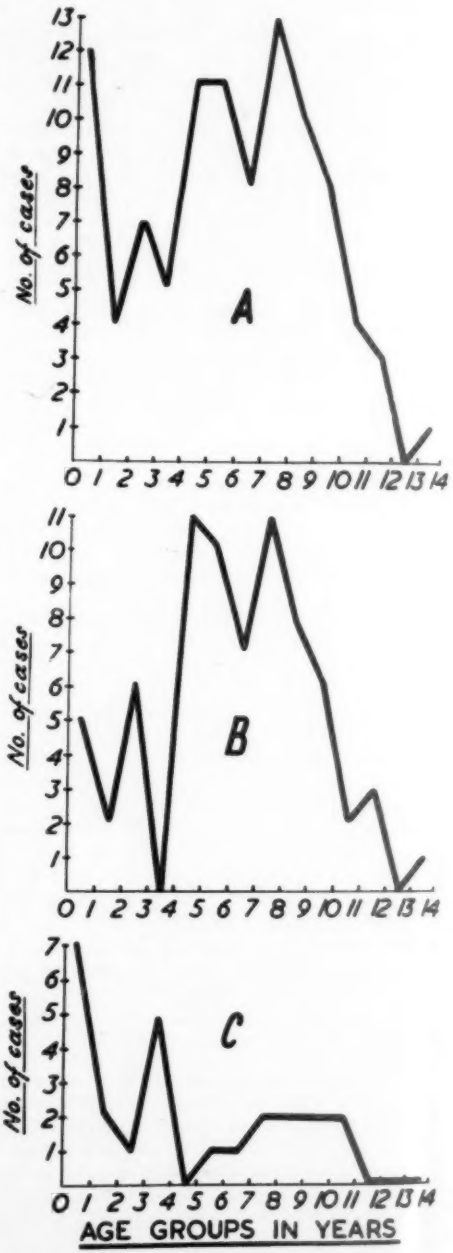

FIG. 1. The age incidence of 97 cases of primary peritonitis.
A. All Cases
B. Females
C. Males

TABLE 2

DISEASES ASSOCIATED WITH 30 OUT OF 97 CASES OF PRIMARY PERITONITIS

Associated Disease	Number of Cases
1. Nephrosis	13
2. Acute Nephritis	4
3. Subacute Hepatitis	1
4. Recent upper respiratory tract infection	9
5. Recent "red eye"	1
6. Pericarditis	1
7. Congenital Syphilis	1
Total	30

The presenting features of the 31 patients admitted during the past five years were studied in greater detail and are now described.

Pain was the outstanding symptom, and was noted in 23 patients. Of the remaining eight, five patients presented acutely with vomiting, diarrhoea, or abdominal distension, and in 3 patients the onset was insidious.

Diarrhoea has previously been reported to be a characteristic presenting symptom (Bellingham-Smith, 1925; Barrington-Ward, 1937) but was noted in only 6 of these 28 acute cases. Vomiting was twice as common, occurring in 13 patients.

Abdominal distension was present in 13 patients.

It was interesting to find in 10 patients that either the symptoms, or the signs of peritonitis, or both, were mainly right sided, suggesting even more strongly therefore a pre-operative diagnosis of acute appendicitis.

As has been noted by previous writers the onset is often remarkably swift and of the above 23 patients presenting with pain, this symptom had been present for less than twelve hours in eight patients, the shortest time being three hours. The longest complaint of pain was for six days.

Of the 28 patients presenting as abdominal emergencies, the temperature on admission was 101° F. or more in 20 cases, the highest being 104.6° F. When taken in conjunction with pain of short duration a high temperature of this order is rare in acute appendicitis and should bring to mind pre-operatively the possibility of primary peritonitis.

Vaginal discharge, a common finding in healthy young girls, was noted in only 5 patients in the series.

BACTERIOLOGICAL FINDINGS

The bacteriological studies on these patients were by no means complete. In only a minority was identification of the infecting organism based on both smear and culture findings. In many, especially in the early years, the identification was made from a smear alone with greater confidence than would be expressed today. On the other hand, during the most recent years the practice of making an initial smear of the peritoneal pus had, regrettably, fallen into the discard and identification was founded on the routine aerobic culture techniques. It may well be, as originally suggested by Nabarro (1925), that anaerobic organisms are responsible for a higher percentage of these infections than is generally supposed and would not be recovered in culture by routine aerobic techniques. In view of the high proportion of negative findings attending cultural methods, it is obvious that the help which a smear can give to assist provisional diagnosis of the responsible organism should not be ignored and the practice of making such a smear at operation should be revived.

The bacteriological findings from this series, taken at their face value, are listed in Table 3 without any attempt to discriminate as to the methods by which they were obtained.

Pneumococci and haemolytic streptococci were the commonest offenders, and this has been the universal experience, but the local predominance of pneumococcal infections, both in earlier and in recent times, was in contrast with the higher incidence of streptococcal infections in most of the overseas studies already quoted. In Brown's experience (1953) at the Royal Hospital for Sick Children, Edinburgh, streptococcal infections were twice as common as pneumococcal prior to 1939 but in the five years preceding 1953 their relative frequency had been reversed.

There was no correlation between the presence of a vaginal discharge and the finding of pneumococci in the vagina.

In those patients in whom pneumococci were demonstrated both in the peritoneal cavity and vagina there was nothing to indicate either ascent or descent of the organisms along the female genital tract.

receiving antibiotics prior to the swab being taken.

It is to be noted that eight of the patients in whom pneumococci were implicated were males.

These observations give little support to the hypothesis (Fraser and McCartney, 1922)

TABLE 3

BACTERIOLOGICAL DATA FROM 97 PATIENTS WITH PRIMARY PERITONITIS

Details	Number of Cases		
	Males	Females	Total
A. Positive peritoneal identification			
1. Pneumococci	8	42	50
2. Beta-haemolytic streptococci	7	8	15
3. B. Coli	—	2	2
4. Staph. aureus	—	1	1
5. Staph. albus (?contaminant)	1	—	1
6. Proteus	1	—	1
7. Paracolon bacillus	—	1	1
8. Diphtheroids	—	1	1
Total	17	55	72
B. Negative peritoneal findings			20
C. No peritoneal swab taken			5
Total			97

From only 5 of the patients in whom pneumococci were found in the peritoneum had vaginal swabs been taken. Pneumococci were grown in culture from 3 of these: from the other two, nothing was cultivated. Vaginal swabs were taken from 7 of those patients in whom the peritoneal findings were negative, but only 3 of these grew pneumococci in culture. One grew a haemolytic streptococcus, one gave a mixed growth of Bacterium coli, Staphylococcus albus and diphtheroids, and two yielded no growth.

Only two of the patients exhibiting no growth from a peritoneal culture had been

that pneumococcal peritonitis is invariably the culmination of an ascending infection of the female genital tract.

Apart from this, our findings provided no information as to the likeliest pathway of infection, a problem which is as yet unresolved and which has been dealt with at length by other writers (Fraser and McCartney, 1922; Barrington-Ward, 1937; Ladd and Gross, 1941).

MORTALITY

The most striking thing in regard to the mortality was the sharp decrease in the death

rate during the past decade (Table 4 and Fig. II). Some abrupt and radical innovation in treatment must be sought to explain this decrease.

TABLE 4

FIVE YEAR INCIDENCE AND MORTALITY OF PRIMARY PERITONITIS AT THE ROYAL CHILDREN'S HOSPITAL, MELBOURNE, 1926-1955

Period	Number of Cases	Deaths	Mortality (Per Cent.)
1926-1930	13	7	53.8
1931-1935	14	6	42.9
1936-1940	23	10	43.5
1941-1945	2	1	50.0
1946-1950	14	1	7.1
1951-1955	31	5	16.1
Total	97	30	—

The death rate in the first two decades was in line with overseas figures during that period which ranged from 54 per cent. (Cole, 1937) to 100 per cent. (Lipshutz and Lowenburg, 1926) and averaged about 75 per cent. (Ryan, 1953).

The results during the last decade are at least as good as those reported from the best centres abroad using modern methods of treatment. Thus, for patients dealt with surgically, Gross (1953) gives a present day mortality of 18.1 per cent. as compared with a mortality prior to 1930 of 65 per cent. He claims, however, that even before the introduction of antibiotics this level of success had already been achieved by the combined measures of gastric suction, parenteral fluid therapy, and early limited laparotomy with drainage. He places greatest emphasis on the value of peritoneal drainage, a view which is subscribed to by Waugh (1925), Nelson (1950), Moncrieff and Evans (1953) and Maingot (1955).

Gross incidentally condemns concurrent appendicectomy which, in his opinion, raises the mortality.

Since the above views are contrary to local experience our findings with regard to the relative effect on mortality of antibiotics, surgical procedures and resuscitation measures are now put forward.

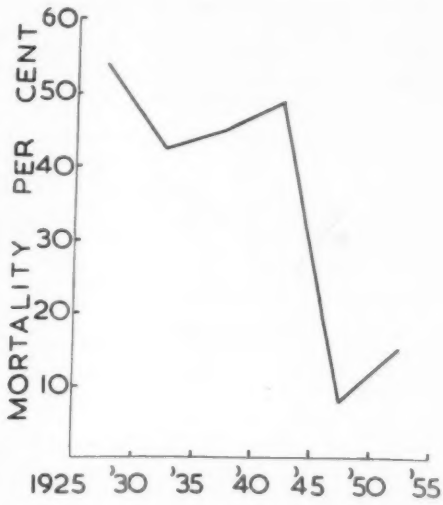

FIG. II. The five-year mortality rates for primary peritonitis at the Royal Children's Hospital, Melbourne, during the thirty-year period 1926-1955.

Chemo-therapy and antibiotics

No patient in the series received antibiotic treatment or chemo-therapy until 1939. Thereafter the last five patients in the 1936-1940 period were treated by sulphonamides without a fatality.

One of the two patients in the 1941-1945 period was given sulphonamides, with recovery: the other died.

The first patient to receive penicillin was the first case in 1946. Thereafter, except for one case not discovered until autopsy, every patient in the last ten years was treated with one or more of the antibiotics, often quite empirically. The frequency of exhibition of each agent or combination of drugs is listed in Table 5.

The number of deaths in the antibiotic era has been too few to justify any preference for one antibiotic combination over another. The bacteriological findings were sufficient to explain a high percentage of successes from any of the above regimens. Chiefly on practical grounds, therefore, it is allowable to recommend the combination of penicillin and

streptomycin as the immediate treatment of choice, subject to modification in particular cases by the bacteriological findings.

TABLE 5

THE CHOSEN FREQUENCY OF ADMINISTRATION OF THE VARIOUS ANTIBACTERIAL AGENTS

Treatment	No. of Cases
1. Sulphonamide alone	6
2. Penicillin alone	19
3. Penicillin and Sulphonamide	3
4. Penicillin and Streptomycin	18
5. Penicillin with one or more broad spectrum antibiotic	3
6. Aureomycin alone	1

Surgical procedures

A summary of the various procedures performed and a comparison of the results achieved in the pre-antibiotic and antibiotic eras is given in Table 6.

Between the mortality of those patients who had no operation and those dealt with surgically no valid comparisons could be made because the former comprised mostly cases with an insidious onset, diagnosed only at autopsy, or those already *in extremis* when admitted.

However, some useful conclusions can be drawn from a comparison of the results of full-scale surgical manoeuvres in cases prior to 1939 (Table 7).

Table 7, which expresses the essence of the surgical mortality in the pre-antibiotic era, excludes from consideration those patients presenting with a localized abscess, who had

TABLE 6

A SUMMARY OF SURGICAL PROCEDURES AND RESULTS IN THE PRE-ANTIBIOTIC AND ANTIBIOTIC ERAS

Surgical Procedures	1926 - 1939		1939 - 1955	
	No. of Cases	Deaths	No. of Cases	Deaths
1. Laparotomy alone, by lower paramedian incision				
(a) with peritoneal drainage	8	3*	4	—
(b) without drainage	2	1	7	—
2. Laparotomy and appendicectomy by lower paramedian incision				
(a) with peritoneal drainage	2*	1	—	—
(b) without drainage	1	—	—	—
3. Appendicectomy through a right iliac muscle splitting incision				
(a) with peritoneal drainage	7	2	2	—
(b) without drainage	11	5*	27	—
4. Drainage of presenting intraperitoneal abscess	2	—	—	—
5. Right iliac muscle splitting incision without appendicectomy and with peritoneal drainage	—	—	1	—
6. Abdominal paracentesis	3	3	5	1
7. Nil	9	9	6	5
Total	45	24	52	6

* Each asterisk represents a patient who developed a faecal fistula.

already given good evidence of having partly overcome the infection themselves, and those dealt with by parecentesis alone.

TABLE 7

INFLUENCE OF DRAINAGE AND APPENDICECTOMY ON SURGICAL MORTALITY 1926-1939

Surgical Procedure	No. of Cases	Deaths
Cases drained	17	6
Cases not drained	14	6
All appendicectomies	21	8
All cases without appendicectomy	10	4

It can be seen that neither drainage nor concurrent appendicectomy significantly affected the mortality in this period.

It may be argued that two cases of faecal fistula followed appendicectomy but it might just as well be claimed that two out of three fistulae followed the use of drainage tubes, since in one case the appendix had not even been removed.

The summary of the surgical procedures performed on the patients admitted during the antibiotic era (Table 6) shows that the tenor of surgical practice towards these cases had altered little with the years, except that appendicectomy appeared to be less popular from a paramedian approach and the practice of drainage had fallen in frequency and favour. The explanation of the abrupt decrease in mortality cannot lie therefore in changes in surgical practice.

Resuscitation measures

On *a priori* grounds it could be expected that resuscitation measures had contributed to a successful outcome in a number of these cases, but a clear appraisal of their relative contribution to this end is difficult, since the evolution of the principles and practice of intravenous therapy was so gradual during the period covered by this study.

However, it may be worth considering the pattern of intravenous fluid therapy (Table 8) in the patients treated during the past five years, during which the principles and practice of its usage have altered little.

TABLE 8

PATTERN OF INTRAVENOUS THERAPY 1951-1955

Type of Intravenous Therapy	No. of Cases	Survivors
1. Nil	20	18
2. Glucose and electrolyte solutions	9	7
3. Blood plus glucose and electrolyte solutions ..	2	1
	31	26

The two deaths in patients who were not transfused were both in children in whom correct diagnosis was not established until autopsy.

In two thirds, then, of the recent survivals intravenous therapy played no part. It is concluded that neither resuscitation measures nor radical changes in surgical practice have caused the abrupt decrease in mortality in the past decade, and credit is given to chemotherapy and antibiotics for this achievement.

MORBIDITY

The introduction of antibacterial agents has resulted not only in the dramatic lowering of mortality already noted, but also in a relative freedom from sequelae in the surviving patients, a welcome contrast to the state of affairs existing previously (Table 9).

Moreover, this tally of recorded complications probably understates their true incidence in the earlier years, especially in regard to a number of patients with prolonged illnesses, whom we would probably regard today as suffering from varying grades of ileus.

A further crude index of this earlier morbidity is afforded by the average stay in hospitals of surviving patients. If, on account of their prolonged stay for other reasons, the ascitic group is excluded from consideration, then the average stay in the parent hospital before the arrival of antibiotics was forty-nine days. It has been seven days since then. Even allowing for changing practices in relation to the disposal of cases to home or to convalescent hospitals, this represents a truly remarkable reduction in morbidity.

TABLE 9

COMPARISON OF THE INCIDENCE OF RECORDED COMPLICATIONS IN 67 SURVIVING PATIENTS BEFORE AND AFTER THE ADVENT OF ANTIBIOTICS

Complications	No. of Cases	
	1926-1939	1939-1955
No recorded complications	8	40
Residual intraperitoneal abscess	6	—
Wound abscess	3*	1*
Post-operative pneumonia	4†	2
Paralytic ileus	—	2
Faecal fistula	1	—
Total	22	45

* Indicates coincident post-operative pneumonia.
† Indicates coincident paralytic ileus.

PRE-EXISTING ASCITES

Twelve patients with pre-existing ascites were males and six were females, a sex incidence which largely reflects the fact that nephrosis is much more common in boys than in girls (Riley and Davis, 1955).

The following notes may be of interest to those faced with a decision as to whether or not to operate on this type of patient.

Only half of this group presented as acute abdominal emergencies. One third developed as febrile illnesses with no other obvious cause. It is of interest that in one child peritonitis began insidiously during a course of A.C.T.H. therapy and was discovered only at autopsy.

Of the 18 patients in this group pneumococci were isolated from 9 and a streptococcus from one other. In one case, no culture was taken and in seven others attempts to identify the responsible organism failed.

Only 6 patients were submitted to surgery and of these two died from the underlying illness in spite of modern resuscitation and penicillin therapy. One patient treated with sulphonamide recovered after paralytic ileus and bronchopneumonia: one patient treated with sulphonamide, and two others with penicillin recovered without complications.

Out of 13 patients treated non-surgically 7 died, but to 5 of these latter no antibiotics had been given.

TREATMENT

Certain recommendations as to the procedures of choice are drawn from this present study.

If the thesis be accepted that peritoneal drainage is of no real value then surgery is indicated only as a diagnostic procedure when signs of general peritonitis exist and there is doubt whether these are due to the presence of some surgically remediable lesion. This will often be the case unless the child is known to have ascites from nephrosis or some other cause. For this latter group it is hard to believe that operation can be anything but harmful, even though some of the ascitic patients in this series did recover uneventfully.

When diagnostic laparotomy is undertaken on a previously normal child the finding of primary peritonitis is no indication to drain the peritoneum. When a right iliac muscle splitting incision is employed there is then an obligation to remove the appendix, a step which in such circumstances carries no special risk.

For patients with pre-existing ascites the following plan of management is put forward. Firstly, fluid should be obtained by abdominal paracentesis to confirm the diagnosis by smear and culture methods. If the smear shows an obviously faecal flora then diagnostic laparotomy should be undertaken, since it must not be forgotten that these children may also develop acute appendicitis. However, if pneumococcal or streptococcal peritonitis is indicated by the smear then antibiotics should be given, and only in those cases not improving after a reasonable trial of such drugs will the question of diagnostic laparotomy arise again.

Diagnostic paracentesis is not recommended in previously normal patients.

SUMMARY AND CONCLUSIONS

With a report of 3 case histories, and an analysis of 97 cases from the Royal Children's Hospital, Melbourne, this paper traces the natural history of primary peritonitis during the past thirty years.

Our local experience contradicts the prevailing notion that surgery is of any value in the treatment of this condition but gives full credit to the introduction of antibiotics for the abrupt fall in its mortality and post-operative morbidity during the past decade.

On the basis of this experience a plan is put forward for the management of primary peritonitis

(a) In previously normal patients, in whom diagnostic laparotomy is the necessary procedure.

(b) In patients with pre-existing ascites for whom non-operative treatment is advised.

In our experience there was no contra-indication to concurrent appendicectomy, and it is felt that this additional step should be taken when diagnostic exploration is made through a right iliac incision.

ACKNOWLEDGEMENT

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TUMOURS OF THE SALIVARY GLANDS

By Howard H. Eddey

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SALIVARY gland tumours may be met with in the paratoid, submandibular and sublingual salivary glands as well as in ectopic salivary tissue in the oral cavity and upper respiratory tract. They occur with greatest frequency in the parotid salivary gland, with equal frequency in the submandibular salivary gland and in ectopic salivary tissue and with least frequency in the sublingual salivary gland.

For many years the treatment of salivary gland tumours consisted of simple enucleation of the tumour and many facets of the problem of the management of these tumours were ill-understood. In recent years, much information has been gathered concerning the pathology, diagnosis and treatment of these tumours and recent surgical literature contains many contributions on this subject. Whilst the diagnosis of these tumours usually presents little difficulty, uncertainty still exists concerning such aspects as the correct surgical procedure necessary to prevent or minimize recurrence, the operation indicated for recurrent tumours, the technique of maintaining integrity of the facial nerve at operation, the risk of local seeding when the tumour breaks during removal, the diagnosis and management of carcinoma, the necessity or otherwise of dissecting the cervical lymph nodes in continuity, whether surgery should be followed by radiotherapy and other problems.

The purpose of this paper is to discuss these and other aspects in the management of these tumours and the information contained represents the writer's personal experience, over the last ten years, of 49 patients with salivary gland tumours.

Pathology

Classification of the types of tumour which occur in a salivary gland is complex but six varieties may be met with by the clinician.

1. Adenoma.
2. Pleomorphic adenoma (mixed salivary tumour).
3. Pleomorphic adenocarcinoma (malignant mixed salivary tumour).
4. Anaplastic carcinoma.
5. Squamous cell carcinoma.
6. Adenolymphoma.

The simple adenoma is an uncommon tumour, is encapsulated and does not recur after enucleation. The most common tumours of the salivary glands are the pleomorphic adenomata and adenocarcinomata, these comprising tumours of similar characteristics but with varying degrees of malignancy. They are epithelial tumours which undergo mucoid change, the appearance giving rise to the commonly used term, mixed salivary tumour. The activity of these tumours varies, so that at one end of the scale is the pleomorphic adenoma which will not recur after removal and at the other is the pleomorphic adenocarcinoma which will recur locally unless adequately excised. It is not always possible to give an accurate estimate of the degree of innocency or malignancy of a pleomorphic tumour on pathological examination and this is an important fact in considering the correct method of treatment of these tumours.

The anaplastic carcinoma represents the most active tumour of the salivary glands: it will recur locally if inadequately excised and it may metastasize widely although cervical node metastases are uncommon.

Squamous cell carcinoma behaves as it does elsewhere showing the usual tendency to metastasize to the cervical lymph nodes.

The adenolymphoma is a specific tumour which may occur in the parotid salivary gland and it has been described also as occurring in the submandibular salivary gland; it is readily enucleated and does not recur.

Tumours of the Parotid Salivary Gland

The writer's experience of parotid salivary gland tumours is based on the surgical treatment of 39 patients. The frequency of the

various types of tumour which have been met with is as follows:—

Pleomorphic adenoma	20
Pleomorphic adenocarcinoma .	4
Recurrent pleomorphic adenoma and adenocarcinoma	6
Anaplastic carcinoma	3
Squamous cell carcinoma	3
Adenolymphoma	3

The diagnosis in each case has been made on the result of histological examination of the operative specimen. With the exception of the adenolymphomata (which were all observed in males) all tumours were more frequent in the female (ratio 1.6 : 1).

It is possible in many cases to make an accurate estimation of the type of tumour present before operation and this is of inestimable value because the extent of the surgical treatment necessary varies according to the type of tumour present as does the outlook for the patient and for her facial nerve. What may be an adequate operation for one variety of tumour is entirely inadequate for another. Facts which aid diagnosis are the rapidity of growth of the tumour, the size and shape, the situation in the gland, the occurrence of multiple tumours, the occurrence of pain or tenderness, the presence of any degree of facial nerve paralysis and the occurrence of enlarged cervical lymph nodes.

Pleomorphic adenoma and adenocarcinoma (mixed salivary tumour)

These tumours are relatively common. They commence as a firm rather spherical nodule in the superficial lobe of the gland between the ramus of the mandible and the anterior border of the sternomastoid muscle just below its origin from the mastoid process and just below the lobe of the ear. A nodule in the parotid salivary gland elsewhere than in the classical site should render the diagnosis of mixed salivary tumour doubtful. (Two patients have been seen in which a smooth firm nodule was present in that portion of the gland overlying the masseter muscle and one to two centimetres anterior to the lobe of the ear. These nodules both simulated a mixed salivary tumour but one nodule, after subtotal parotidectomy, was shown on histological examination to be a granuloma and X-ray examination of the other patient revealed a calculus in the centre of the nodule.)

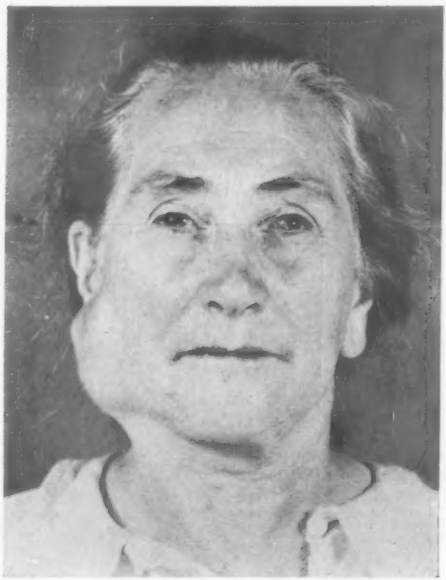

FIG. I. Photograph of a patient showing a typical mixed salivary tumour in the right parotid salivary gland. The tumour is nodular, lies in the mastoid-mandibular fossa, pushes the lobe of the ear outwards and does not involve the facial nerve.

As the tumour slowly increases in size it becomes nodular and pushes the lobe of the ear outwards (Fig. I). The tumour does not cause paralysis of the facial nerve and it remains firm and free from pain or tenderness. As it enlarges it also extends inwards and compresses the deep lobe of the gland but it does not as a rule cause great distortion of the branches of the facial nerve as they pass between the superficial and deep lobes of the gland.

Less commonly the tumour may commence in the deep lobe of the gland (Fig. II), and as it increases in size becomes palpable in the mastoid-mandibular fossa as a firm lobulated swelling.

When the tumour is of moderate or large size it is impossible to state with any certainty whether the tumour has arisen in the deep or in the superficial lobe. This is important when advising a patient concerning the likelihood

of temporary or permanent facial nerve paralysis after operation. When a tumour arises in the deep lobe it enlarges outwards between the cervico-facial and temporo-facial divisions of the nerve producing considerable displacement of the former division downwards. This renders dissection of the tumour containing deep lobe difficult and it is often impossible to avoid considerable stretching of the cervico-facial division so that some temporary paralysis of lower lip muscles is inevitable.

FIG. II. Photograph of a specimen removed by total parotidectomy showing a mixed salivary tumour in the deep lobe, a central isthmus and a normal superficial lobe. The cervico-facial division of the facial nerve was displaced inferiorly around the lower surface of the tumour.

The technique of subtotal parotidectomy used (Eddey, 1951) is most satisfactory for tumours involving the superficial lobe but when the tumour arises in the deep lobe a total parotidectomy must be performed. Since the tumour in the deep lobe spreads the main divisions of the facial nerve, it is of great value to dissect from below and lift the lower pole of the parotid salivary gland upwards to locate the cervical and mandibular branches of the lower division of the nerve. This, together with exposure of the main trunk of the nerve posteriorly, as it enters the gland just below the inner end of the cartilage of the external auditory meatus (Fig. III), considerably lessens the risk of damage to the lower division. In no case has it been found necessary to ligate the external carotid artery. Haemostasis has been secured by elevating the head and shoulders of the patient on an adjustable operation table and by infiltrating the area to be dissected with a 1 in 100,000 solution of adrenalin hydrochloride. Hypotensive anaesthesia may be used and this, together with head elevation, provides an almost bloodless field of operation which has been very useful on three occasions in young attractive female patients.

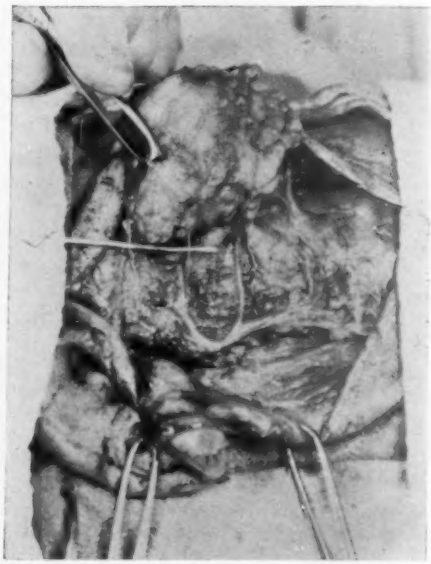

FIG. III. Photograph illustrating the technique of subtotal parotidectomy. The superficial lobe of the gland has been dissected off the masseter muscle and the branches of the facial nerve have been mobilized from the fascia on the posterior surface of the superficial lobe. The main trunk and the primary divisions of the nerve lie just below the medial end of the cartilage of the external auditory meatus.

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. It is often impossible, during dissection of a large or moderate sized tumour, to prevent rupture of the tumour and spilling of its contents over the wound. This occurs particularly with tumours arising in the deep lobe following the necessary retraction of the gland to dissect free the divisions of the facial nerve to prevent injury. Whether this spillage results in recurrence of the tumour is not known because of the long follow-up necessary to prove this point, but careful wound toilet should lessen the likelihood. To date no recurrence has developed in those patients in whom the tumour has been ruptured at operation.

Post-operative radiotherapy is unnecessary following adequate surgery and these tumours are relatively insensitive to X-ray.

It is, of course, unnecessary to dissect the related lymph nodes in performing a subtotal or total parotidectomy for mixed salivary tumour. However, it is important to recognize that one or more of the related lymph nodes may be considerably enlarged pale and firm in the presence of a large or moderate sized mixed salivary tumour (Fig. IV). This must be recognized and not regarded as a metastasis necessitating a neck dissection; if in doubt a frozen section will confirm the diagnosis of sinus hyperplasia.

FIG. IV. Photograph of a specimen removed by subtotal parotidectomy showing above, a mixed salivary tumour and below, an enlarged firm related lymph node.

No patient in this group sustained permanent facial paralysis. Two patients had almost complete paralysis following a rather difficult total parotidectomy for a large tumour with considerable traction on, but without division of the nerve. Both patients recovered fully within three months. Several patients had weakness of the lower lip following operation and this always resulted from traction on the marginal mandibular branch of the nerve which appears to be much more sensitive to traction than any other branch. All patients recovered although two still have a very slight and hardly noticeable weakness of the muscles at the corner of the mouth. Provided the surgeon is satisfied that the parotid gland has been removed without damage to the nerve, any patient who has weakness of the facial musculature postoperatively can be reassured and no specific treatment is indicated for the muscle weakness. If a branch of the nerve is divided, suture should be performed at the end of the operation.

No patient has developed a salivary fistula from the deep lobe which remains after subtotal parotidectomy. In fact a deep lobe of two to three centimetres in diameter has often remained after operation and never has drainage of saliva through the wound occurred. This failure to secrete saliva from the remaining deep lobe is almost certainly due to division of the secreto-motor branches of the auriculo-temporal nerve to the gland during operation. It is quite unnecessary to make formal exposure and divide this nerve. The use of an underwater seal drain in the wound allows the skin flaps to adhere to the dissected area and prevents collection of serum.

Three patients have developed sweating and redness of the cheek skin upon eating (Frey's syndrome) but this complication has only been elicited from the patient on direct questioning; it has not concerned the patient over-much. The greater auricular nerve is always divided at operation but the area and degree of sensory loss over the postero-inferior skin of the cheek lessens with time. Any attempt to preserve this nerve adds an unnecessary difficulty to the operation as the ultimate area of sensory loss is small and rarely troubles the patient. It is possible in many cases to preserve the branch of the nerve supplying the skin of the lobe of the ear, particularly when this branch is given off as the nerve is crossing the sternomastoid muscle immediately below the mastoid process.

No patient who has a subtotal or total parotidectomy for mixed salivary tumour arising either in the superficial or deep lobe has had recurrence of the tumour over the period of follow-up which extends between six months and ten years. In one patient two small nodules were noted under the skin over the masseter muscle eighteen months after subtotal parotidectomy performed six years ago. These nodules have been carefully observed but since they have remained unaltered

no treatment has been instituted. It is considered that these nodules represent tissue proliferation around a suture and not recurrence.

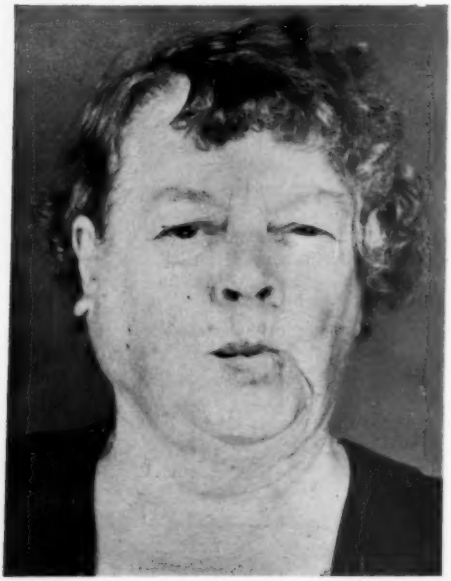

FIG. V. Photograph of a patient with an anaplastic carcinoma of the right parotid salivary gland. The tumour involves the whole gland, its surface is smooth and paralysis of the muscles of the lower lip is present.

Recurrent pleomorphic adenoma and adenocarcinoma (recurrent mixed salivary tumour)

Recurrence of a mixed salivary tumour indicates (a) inadequate removal or (b) a new tumour formation in glandular tissue previously uninvolved. In all six cases in this group recurrence had followed a local excision performed elsewhere. In one case three separate nodules developed in the gland at or near the site of the previously excised mixed salivary tumour, thus supporting the view that a neoplastic change was occurring in a considerable portion of the gland. Two patients gave a history of having had a sebaceous cyst "with deep roots" removed previously and in one of them such an operation had been performed twice before the true nature of the tumour was recognized by the attending physician. It is obvious that these tumours must have been small and quite superficial in the gland, although they were both in the usual situation.

It is certain that to prevent recurrence of a mixed salivary tumour, an adequate margin of normal gland surrounding the tumour must be removed and this is most easily accomplished by a subtotal parotidectomy if the tumour is in the superficial lobe or a total parotidectomy if it is in the deep lobe, these operations being so planned as to ensure integrity of the facial nerve. Parotidectomy for a recurrent tumour commencing in or enlarging to involve the deep lobe is a difficult operation and it is often impossible to avoid damage to one or more branches of the facial nerve. If for no other reason this is a cogent argument to advise adequate primary surgery.

Two of the six patients in this group have a mild permanent lower facial paralysis which resulted from division of a branch of the cervico-facial portion of the nerve to ensure an adequate operation. One other case in which a branch of the nerve was cut has no paralysis because of an anastomosis, which is relatively common, between branches from both divisions of the nerve.

There has been no recurrence of tumour in any of these six patients, during the period of follow-up.

Anaplastic carcinoma

This tumour represents the extreme grade of malignancy of epithelial tumours of the salivary gland. It is diagnosed by the relatively rapid onset and by the smooth surface of the tumour which usually appears to involve the whole gland (so much so that a diagnosis of parotitis may be made). Pain and tenderness are common features but paralysis of the lower division of the facial nerve is not common, although if present, it confirms the diagnosis (Fig. V). Whilst these tumours may metastasize widely it is uncommon to find metastasis in the cervical lymph nodes. The treatment therefore consists of total parotidectomy including excision of the facial nerve as it is related to the gland and its tumour. Before proceeding on this deforming procedure, it is essential that the diagnosis be confirmed by frozen section early in the operation. The resulting total facial paralysis can be rendered less disabling to the patient by tightening the lower tarsal plate and by suture of the eyelids together thus obviating the patient's greatest disability of eversion of the lower eyelid with consequent epiphora and conjunctivitis (Fig. VI). If a

trouble free period of a few years elapses other plastic procedures may further lessen the deformity.

These tumours are relatively insensitive to radiotherapy so that post-operative X-ray is not indicated.

All three patients in this group have died from their tumour, the longest survival period being two years.

FIG. VI. Photograph of a patient who has had a total parotidectomy (with excision of the facial nerve and radical neck dissection) for anaplastic carcinoma. Complete facial paralysis is present but eversion of the lower eyelid has been prevented by tightening the lower tarsal plate.

Squamous epithelioma

This tumour is not common and as it enlarges it readily undergoes necrosis and liquefaction. A sudden increase in size from haemorrhage into a necrotic area of tumour may occur and the resulting painful soft tender swelling may be mistaken for an abscess and incised, particularly if the patient had not previously recognized the presence of a tumour. These tumours are usually well differentiated and although total parotidectomy is indicated, it may be possible, depending on the size and situation of the tumour and the precise anatomy of the facial nerve in relation to the gland, to preserve one or two branches of the upper division of the facial nerve as they pass above the central isthmus of the gland thus allowing the patient normal function of the orbicularis oculi muscle. Before modifying the technique in this way, the surgeon must establish the diagnosis by frozen section of the tumour at operation. Radical neck dissection is not indicated unless and until cervical lymph node metastases are apparent. Post-operative radiotherapy is of value particularly if portion of the facial nerve is preserved.

One patient in this group died within one year of operation from cervical recurrence. The other two patients have remained well for a period of one year and eighteen months respectively since operation.

Adenolymphoma

This rather uncommon tumour of the parotid salivary gland is encapulated and does not recur after enucleation. This tumour may be diagnosed pre-operatively as it usually lies at the lower pole of the parotid salivary gland, is smooth and elastic and is mobile on the underlying sternomastoid muscle. Radiotherapy is usually ineffective in treatment of these tumours and since the diagnosis is uncertain until operation, treatment consists of enucleation of the tumour from within its ill-defined capsule if an operative or frozen section diagnosis can be made but if not, a subtotal parotidectomy is performed.

Rare tumours

Other tumours are sometimes met with in the parotid salivary gland and the writer has removed two lymphomata, one lipoma and one angioma. These tumours can usually be diagnosed at operation and treatment consists of enucleation after exposure of the main trunk and divisions of the facial nerve to ensure against damage. One lymphoma presented as a large soft lobular tumour in the gland and its character was only recognized by frozen section at operation. The interpretation of frozen sections of tumours of the parotid salivary gland is somewhat difficult but the writer has been fortunate in having the co-operation of Dr. J. D. Hicks, Pathologist to the Royal Melbourne Hospital, so that planned surgery has always been undertaken.

TUMOURS OF THE SUBMANDIBULAR SALIVARY GLAND

Similar tumours are recognized in this salivary gland as in the parotid and treatment follows the same general principles. Experience of these tumours comprises three cases of pleomorphic adenoma, two of pleomorphic adenocarcinoma (both of which were referred following recurrence after previous local excision) and one case of squamous epithelioma. Diagnosis is usually made without difficulty but metastatic lymph node enlargement from oral epithelioma and inflammatory enlargement secondary to a calculus impacted in the commencement of the duct must be excluded. The treatment of all tumours is total excision of the salivary gland and the submandibular lymph nodes, that is a suprahyoid neck dissection is performed. Care is necessary to avoid damage to the marginal mandibular branch of the facial nerve and to the lingual nerve. The former nerve is identified early in the operation as it passes from the parotid salivary gland behind and below the angle of the mandible beneath the platysma and before it crosses the mandible with the facial vessels. The lingual nerve is freed from the submandibular duct by dividing its branches to the submandibular ganglion since these anchor the nerve in close proximity to the duct.

Malignant tumours are relatively more common in this salivary gland than in the parotid so that a complete suprahyoid dissection is always indicated. Local enucleation of any tumour invites recurrence. Radical neck dissection is not indicated unless significant deep cervical lymph node enlargement is present and radiotherapy plays no part in the treatment of these tumours.

No recurrence of tumour has so far developed following adequate operation for pleomorphic adenoma or adenocarcinoma in the gland. The patient with a squamous epithelioma died following cervical recurrence several months after a radical neck dissection was performed for cervical metastasis which developed six months after the primary operation for removal of the tumour (Fig. VII).

The writer has not treated any tumour of the sublingual salivary gland but any such tumour should be dealt with by total excision of the gland.

TUMOURS OF ECTOPIC SALIVARY GLAND TISSUE

Ectopic salivary gland tissue may occur in the oral cavity, in the upper respiratory tract and rarely in other situations such as in the scalp, eyelids and neck. The writer has seen one example of a salivary gland tumour presenting as an ulcer in the skin of the neck. The most common site of ectopic salivary gland tumours is under the mucosa of the palate. Four palatal tumours have been treated; two were pleomorphic adenomata and two were pleomorphic adenocarcinomata, the latter being operated upon after previous inadequate surgery.

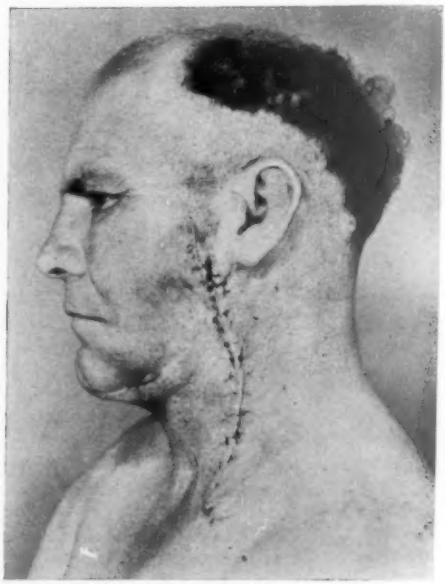

FIG. VII. Photograph of the patient who has been treated for a squamous epithelioma of the left submandibular salivary gland. A radical neck dissection has been performed for cervical metastases which developed shortly after excision of the primary tumour. Cervical recurrence occurred later and the patient died from haemorrhage from the common carotid artery following ulceration of the tumour.

A tumour of such ectopic tissue is readily diagnosed. It presents as a smooth firm nodule underlying the mucosa, usually of the hard palate and it tends to indent the underlying bone as it increases in size. It is not painful and it does not ulcerate unless it is injured or unless it increases rapidly in size.

It is usually impossible to diagnose pre-operatively the nature of the tumour and since the frequency of malignant mixed salivary tumour is relatively higher than in the parotid salivary gland excision should include a margin of normal palate mucosa. Piece-meal removal of these tumours is to be condemned as recurrence is almost inevitable. Radiotherapy is not indicated either as a primary treatment or as a cover for inadequate surgery.

SUMMARY

1. The diagnosis and treatment of tumours of the salivary glands has been discussed, the conclusions being based on personal experience of 49 cases.

2. Adequate surgery is necessary to prevent recurrence of mixed salivary tumours. Radical surgery, usually without lymph node dissection, is necessary for carcinoma, but the outlook for cure is poor.

ACKNOWLEDGEMENT

The photographs are the work of Mr. R. Inglis, Clinical Photographer at the Royal Melbourne Hospital, and to him I am greatly indebted.

REFERENCE

EDDEY, Howard H. (1951), *Aust. N.Z.J. Surg.*, vol. 21, page 13.

PHAEOCHROMOCYTOMA

REPORT OF TWO CASES

By I. H. McConchie, Julian Orm Smith, John B. Somerset

Royal Melbourne Hospital

ISOLATED reports of the clinical behaviour of patients physiologically distressed by the activity of certain unusual tumours of the endocrine glands, are apt to be redundant and even uninteresting, if it has been established that such tumours excite a uniform clinical pattern. At the present time, such an attitude cannot be maintained with regard to the phaeochromocytoma, if only for the reason that on many occasions the discovery of these tumours has been fortuitous, despite the well-known tendency of this new growth to give rise to paroxysmal hypertensive attacks. Therefore, the varied manner of its recognition, if recorded from time to time, may prove to be productive and from such reports may emerge a more precise clinical picture which is kindled by the activity of this remarkable tumour.

Case Histories

Case 1

Mrs. D., aged 42, had been in hospital in a country district for some weeks because of sharp and recurrent attacks of abdominal pain. Her condition gave no immediate cause for concern and it appeared, that for the time being, surgical intervention was uncalled for. Then, quite suddenly, she became distressed by a severe dysuria. She was thereupon transferred by her family doctor to a metropolitan hospital and referred to one of us (J.B.S.) for investigation. Her previous medical history provided one suggestive clinical feature. For eighteen years she had suffered from "epilepsy." Attempts to subdue these fits by a succession of competent medical advisers, with all the latest anti-convulsants at their command, had been ineffective.

At first sight, Mrs. D. might be described as being somnolent. Her blood pressure averaged, on repeated readings, 180/120 mm. of Hg. She resented abdominal palpation especially under the left costal margin. A mass could be felt in her left iliac fossa. This swelling was defined as her left kidney and so, subsequently, it proved to be. Examination of the urine showed no abnormality other than red cells which were few in number. On cystoscopic examination the bladder was normal. A retrograde pyelogram provided the clue (Fig. I). A pre-sacral air insufflation was performed, and two enlightening radiographic films resulted from their procedure (Figs. II and III). A tumour of adrenal origin was the obvious diagnosis. However, the dimensions of the tumour, somewhat inordinate compared with the majority of phaeochromocytoma reported in this country (Whiteside, 1954), raised some feelings of doubt. Nevertheless, an operation was planned without having recourse to the elaborate and somewhat equivocal biochemical tests which had been suggested, and at that time not readily available, but provision was made for a supply of nor-adrenaline to be at hand at the hospital.

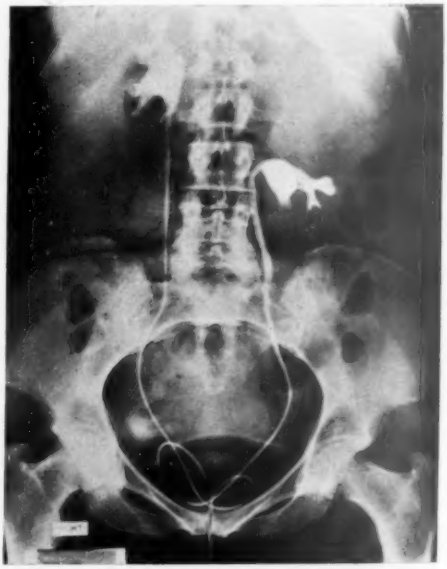

FIG. I. Retrograde pyelogram (Case 1) showing displacement of the renal pelvis caudally.

Operation

It was agreed that an abdomino-thoracic approach would afford the best access and provide for possible contingencies. The incision (I.H.McC.) extended from a point just above the umbilicus, across the costal margin and then along the line of the 8th inter-costal space back to the mid axillary line; the parietal muscles were divided. The periosteum was stripped off the upper border and under surface of the 9th rib and costal cartilage. A subperichondral resection of one inch of the 9th costal cartilage, where it formed the costal margin, was carried out. This measure prevents painful clicking in the post-operative period and does away with the necessity of suturing the costal cartilages, with the attendant risk

of chronic cartilage infection and persistent sinus formation. The peritoneal cavity was then opened and the pleural cavity entered by dividing periosteum and pleura under cover of the 9th rib. The diaphragm was incised for three inches from the divided costal margin towards the oesophageal hiatus. A rib spreader was inserted and the wound opened widely, providing an excellent exposure of all the upper abdominal contents. This exposure, of course,

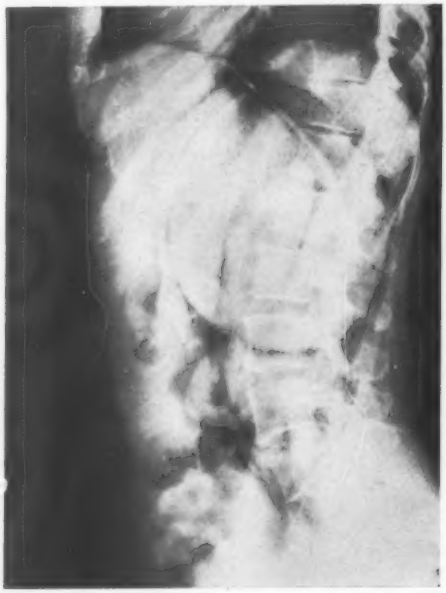

FIG. II. Lateral view of the spine and abdomen after pre sacral air insufflation. The tumour, spleen and displaced kidney are recognizable.

permits mobilization and delivery of the tumour by very gentle handling — an important point in view of the hypertension apt to be produced by squeezing, in an attempt to deliver it through any smaller incision. It is also possible to ligate and divide the medially situated vascular pedicles at an early stage. A cystic swelling was displayed. A nice areolar plane of cleavage was at once entered and the cyst was virtually enucleated after ligating a vascular pedicle which entered it on its medial aspect. The upper pole of the kidney was indented and *within the confines of this depression was a structure which was taken to be the adrenal.* After removal of the tumour the diaphragm was closed with No. 3 chromic catgut sutures and a drainage tube led into the bottom of the pleural cavity and connected to an under water drainage bottle. The 8th and 9th ribs were approximated with pericostal stitches and the pleural and peritoneal cavities closed. During the operation, although he had been alerted in this respect, the anaesthetist made no comment on irregularities of blood pressure. The operation was completed under the hour.

The patient was seen at midnight — eight hours after operation. An intravenous drip of glucose and saline was running. Her pulse rate and blood pressure were normal. She was conscious, warm and comfortable.

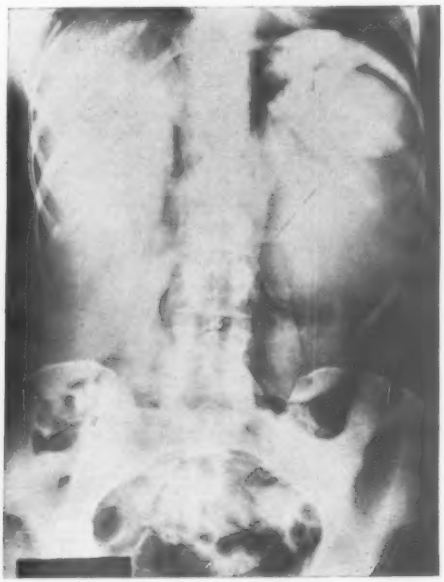

FIG. III. Antero-posterior view of the abdomen (after pre-sacral air insufflation) showing tumour and displaced kidney.

The doubts concerning the precise nature of the tumour, which were harboured before operation by those concerned with the patient's care, were engendered by an innocent remark made in the theatre, by an onlooker, that "it was not an adrenal tumour." And here began a period not entirely devoid of surgical drama. Mrs. D. was a patient in an open 8-bed ward. At 8 a.m. on the morning after her operation, she was seen and professed to be very well; a senior sister gave a satisfactory report. Half an hour later, another one of us called and the patient appeared to be dead. She was unconscious; her jaw was dropped; her pulse impalpable; her blood pressure unrecordable, but she was warm. A rapid inspection failed to reveal any sign of haemorrhage, congealed or apparent, which might have accounted for her collapse. Nor-adrenaline was called for but the supply provided pre-operatively as a contingency had, through a misunderstanding, been taken away from the hospital. Some was obtained rapidly and within twenty minutes of introducing 1 cc. of Levophed into the intravenous drip, the patient's pulse became palpable, the blood pressure recordable, and a few moments later the patient too, entered the drama in which, unconsciously she had played the leading part, by coming to her senses and enquiring "Where am I?"

During the ensuing forty-eight hours a little alteration of the rate of the intravenous drip was required to maintain the systolic blood pressure in the region of 100 mm. of Hg. After 72 hours, the nor-adrenaline was discontinued. Thereafter her convalescence was smooth.

Specimen

The tumour was the size of a well-grown coconut (Fig. IV).

Pathologist's report (Dr. Hicks)

"A cyst, oval on shape 18 x 12 x 9 cm. with suprarenal (? cortex) sitting on the surface near one pole, with flattened islands of cortical tissue spread out over the surface of the cyst, one band extending almost completely around it. The wall is thin and the lining smooth but with adherent necrotic greyish material and blood clot, the contents altered blood clot and necrotic matter.

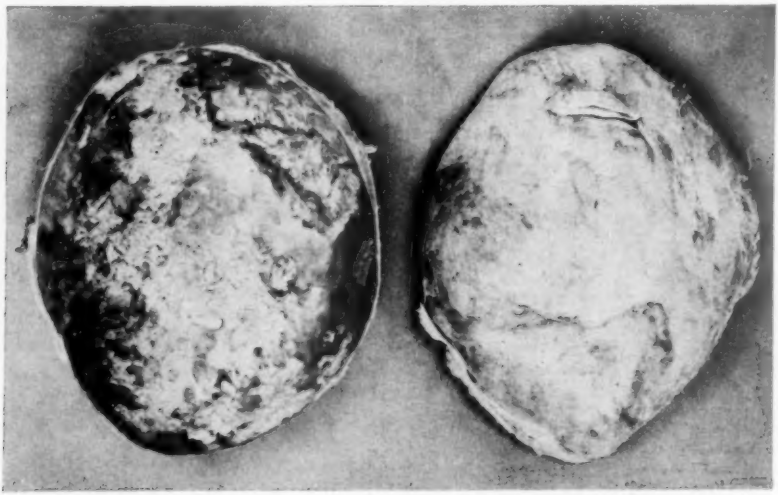

FIG. IV. Photograph of the specimen (Case 1) showing external and internal aspects. The tumour is cystic with some irregular masses of necrotic tissue attached to the capsule.

Microscopic examination

Section through the wall in the region of the yellowish patch shows columns of cortical cells compressed between two layers of fibrous tissue. There is some necrotic material adjacent to the cyst lining together with some blood clot. Section of the solid material from within the cyst shows structureless debris without cellular detail."

Many sections of the wall were made without clear evidence of the nature of the tissue being determined histologically with complete certainty but in view of the clinical history it is apparent that the necrotic tissue was, in fact, originally that of a phaeochromocytoma. Cysts in this region frequently contain the merest remnant of the original parenchyma and in this case clear-cut observations of surviving tissue were not made. It was the considered pathological opinion however, taking all the features into consideration, that the nature of the original growth was not in doubt.

After leaving hospital, the patient and her family entertained great hopes, as did all of us concerned with her care, that a complete cure had been effected. For some time she had no more fits and her family and friends remarked with pleasure upon her change from a semi-invalid to a bright and happy individual. But this improvement proved to be temporary. Within a few months her fits returned and all manner of complaints were made by the patient, who reverted to an introspective unhappy woman.

She was readmitted to hospital for review. She was hypertensive, her blood pressure on admission being 240/140 mm. of Hg., but this was labile and she had a blood pressure of 150/90 mm. of Hg. during her stay. A Regitine test was carried out and disclosed a fall in blood pressure within a few minutes from 120 mm. of Hg. diastolic to 90 mm. of Hg. diastolic. However, the urine test for pressor amines proved to be normal. X-ray examination of the renal tract revealed no abnormality.

The retinal vessels showed signs of early sclerosis and there were a few tiny capillary haemorrhages in each eye. Dr. E. Graeme Robertson regarded the "fits" as the nature of temporal lobe epilepsy. Psychiatric enquiry suggested a neurotic element in which there was a high degree of latent sexual antagonism. The present state of her health, assessed from both the physical and psychiatric standpoint is disappointing.

Case 2

Within a few weeks of operating on the patient whose history has been referred to above, Mrs. E.K., aged 48, was referred by Dr. W. E. King with the

diagnosis of phaeochromocytoma. Her history was, that for fourteen years she had been subject to attacks which consisted of pallor, palpitations, dry retching and severe headache, and these attacks had been increasing in number and severity over the years. She also complained of some blurring of vision, giddiness and shortness of breath on exertion. There was little to find on clinical examination, apart from a blood pressure reading of 220/110 mm. of Hg. Her heart was of normal size and there was no evidence of failure nor of retinopathy. Investigations proceeded in regular fashion until an intravenous pyelogram showed the left kidney to be displaced downwards and the tomogram revealed that this was caused by a well defined rounded mass in the suprarenal region. Subsequently a Regitine test was performed which produced a fall in blood pressure of 50/30 mm. of Hg. Firm palpation under the left costal margin on two occasions induced a hypertensive attack with symptoms identical to those from which she had previously suffered.

A similar abdomino-thoracic approach was employed (I.H.McC.). The exposure of the tumour, or rather, its delivery was uneventful. During the operation the blood pressure rose to 240/140 mm. of Hg., but this elevation was neutralized by the injection of Regitine. It was interesting to be able to confirm, at an operation on the living subject, the anatomical textbook description of the blood supply of the adrenal gland. Three distinct vascular pedicles were, on this occasion, ligated and divided. In the immediate post-operative period the patient's blood pressure fell, for a time, to 90/60 mm. of Hg., but this was corrected by the infusion of noradrenaline. After forty-eight hours the blood pressure became stable at 120/70 mm. of Hg. The patient was discharged from the hospital on the fourteenth post-operative day. Since that time she has had no complaints of ill-health and her blood pressure is normal.

Specimen

Pathological report (Dr. Hicks)

"Macroscopic examination

The specimen weighed 310 gm. It is about 8 cm. in diameter with a band of suprarenal cortex running across the surface and small islands of yellow cortical tissue scattered in the fascia away from the main band of cortex. On section there is a cyst about 6 x 4 x 4 cm. containing dark fluid. There are areas of solid greyish yellow tissue around the cyst 1-3 cm. in thickness.

Microscopic examination

The solid areas consist of epithelial cells in groups of solid alveoli supported by their blood vessels and delicate stroma. The cells are rounded or elongated, the cytoplasm generally of fine eosinophilic granules. Some cells are larger with more cytoplasm and in places there are brownish pigment granules. The nuclei are rounded, relatively small and even in size, except that larger cells have long band-like nuclei — phaeochromocytoma of adrenal."

ACKNOWLEDGEMENT

Mr. Roy Inglis of the Royal Melbourne Hospital is responsible for the reproductions.

REFERENCE

WHITESIDE, M. G. (1954), *Med. J. Aust.*, vol. 2, page 748.

URETHRAL SUSPENSION

A PRELIMINARY REPORT ON A NEW APPROACH TO THE PROBLEM OF STRESS INCONTINENCE IN THE FEMALE

By Leslie W. Gleadell and Robert F. Zacharin

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DISSATISFACTION with the results of the methods generally used for the treatment of stress incontinence is universal.

We feel the pathology of the lesion is not complex and its mode of treatment should be simple. Because of the many cures reported from methods not involving the vesical sphincter we assume this sphincter to be normal in stress incontinence. Recent workers have focussed attention on the inferior surface of the urethra and its junction with the bladder neck. Some sling techniques are major surgical procedures associated with a mortality rate.

Anatomy

The urethra has been dissected in fresh post-mortem material by one of us (R.F.Z.). It has a drawn out S shape and in our opinion is maintained in its normal position by a fascial investing sling fused intimately with the superior urethral wall in the region of the subpubic arch against which it is tightly held. This sling is constant and consists of an anterior and a posterior part, being saddle shaped and embracing the subpubic arch. The distal urethra is suspended by an extension of the suspensory ligament of the clitoris which takes strength from the anterior interpubic ligament and the deep fascia of the adductor longus on either side. This forms the anterior limb of the suspensory mechanism.

FIG. I. Shows the drawn-out S shaped nature of the female urethra.

FIG. II. The posterior surface of the symphysis showing the two arms of the posterior suspensory mechanism of the urethra.

The junction of the distal two thirds and proximal third of the urethra is suspended by aponeurotic extensions of the inner borders of the levatores ani which form the posterior portion of the suspensory mechanism. These suspensory ligaments are macroscopic, devoid of muscle, being firmly attached to the urethra and are of fixed length. Dissection of this region in the male demonstrates two homologous ligaments — the pubo-prostatic ligaments.

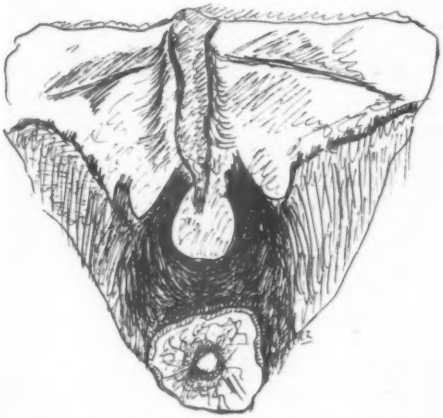

FIG. III. A line drawing of the photograph (Fig. II).

Pathology

Stretching of the fascial attachments supporting the proximal portion of the urethra allows a straightening of the urethra with subsequent impairment of action of the external sphincter. The straightening of the urethra is demonstrated radiologically by micturition cysto-urethrogram.

The micturition pressures have been recorded using a double manometer method after the pattern of that used by Denny-Brown and Robertson (1933). These tests show that there is a reduction of micturating pressure from the normal 18-20 cm. of water to as low as 6-10 cm. of water.

The bladder mucosa is normal and cystoscopy must be carried out in every case to exclude bladder pathology and low capacity. A routine neurological examination is essential.

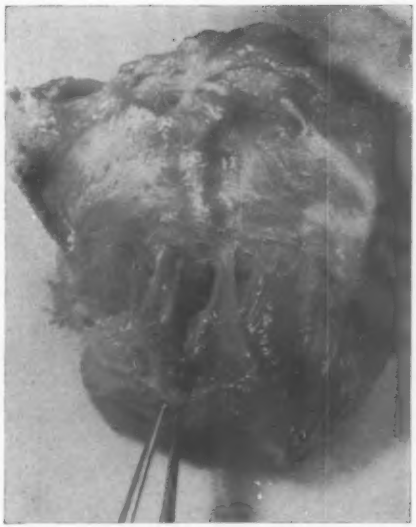

FIG. IV. The pubo-prostatic ligaments in the male (the forceps are holding the prostate).

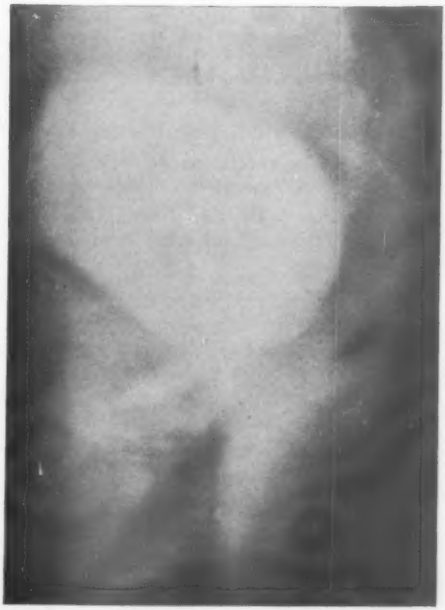

FIG. V. Demonstrates the straight urethra, the increased bore of the urethra and the fact that many have an abnormally short urethra.

FIG. VI. Photograph taken at operation. A metal catheter is in the urethra. The wide space beneath the subpubic arch is well shown.

These investigations have been carried out on the following groups:—

(a) Patients with minimal prolapse.

(b) Patients unrelieved by one or more previous reparative procedures.

(c) Patients with true gravitational stress incontinence without spontaneous remissions.

(d) Patients without associated urinary tract pathology.

and the procedure has been performed when the following criteria have been demonstrated:—

(i) Normal lower urinary tract particularly with respect to bladder capacity.

(ii) Straight urethra.

(iii) Low micturating pressure.

(iv) Absence of general medical or neurological disease.

MANAGEMENT

Under anaesthesia the patient is placed in the lithotomy position, the bladder being emptied by catheter. An inverted Y-shaped incision is made from just below the clitoris and each limb of the Y embraces the urethral meatus.

The anterior suspensory ligament is divided. Access is obtained to the space between the subpubic arch and the urethra. The space is increased as a result of the stretching of the posterior ligaments.

Three sutures of No. 2 chromic catgut are passed, two through the para-urethral tissues, and the third through the superior surface of the urethra; they are then passed through the periosteum on the postero-inferior surface of the pubic arch in the region of the attachment of the suspensory ligaments. The skin, together with the anterior suspensory ligament, is closed with interrupted No. 0 catgut. A self-retaining rubber catheter (No. 10) is inserted for continuous drainage for five days.

Seventeen cases have been treated by this method. We realize no method can be assessed until a period of time has elapsed but we are encouraged by the early results to hope that a simple procedure to cure this common annoying complaint has been described. A full report of our results will be published later.

ACKNOWLEDGEMENTS

We wish to acknowledge the help obtained from the Department of Anatomy, University of Melbourne; from Dr. Barbara Wood for her encouragement with the radiology; from Dr. J. D. Hicks for his help with collection of specimens and Mr. R. Inglis for the photography, and the nursing and resident staffs of The Royal Melbourne Hospital where this work was undertaken.

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THE MANAGEMENT OF MAJOR THORACIC TRAUMA

By JOHN BORRIE

Department of Surgery, University of Otago, and Thoracic Surgical Department, Dunedin Hospital

THE six fundamental principles in the management of major thoracic trauma are to:

(1) Give oxygen and secure the airway;

(2) relieve intra-pleural tension;

(3) relieve the pain;

(4) stabilize the chest wall;

(5) give blood as required, and

(6) explore the chest when indicated.

Though in theory, by applying these rules, all patients should recover, in practice this is far from being true. It is this particular aspect, the serious chest injury following major trauma that reaches hospital yet not always lives, and as seen from the clinical standpoint, that is discussed in this article. Some at least of these unfortunate patients can be rescued. How active should one be, or can one be in their management? This problem at some time or other faces all surgeons.

In a series of 30 chest injuries referred in the past three years, a third had violent accidents. Six died, 3 within six hours, 2 within nineteen hours, and a sixth after three days. I do not propose to dwell on the 24 recoveries, but rather to discuss those who died, in the hope that, by pooling such experience, one can unify a plan for treating them.

The following points seem significant

(1) This problem is as old as man, and confronts him in war and peace. The medieval knight in full armour, unhorsed in combat has largely been replaced by victims of modern civilization with its high speed vehicles. The difference is that by applying modern concepts of chest structure, function and disorder, more can recover now than then.

(2) One notes the wide variety of accidents causing these injuries, varying from being crushed between a car and a bus, to being thrown from a motor cycle, from being hit by a truck to crashing down a bank in a lorry, from being caught on a jigger by a railway engine, to being tossed by a bull in a paddock.

(3) The exact pathological lesion, not always obvious, varies greatly in extent and severity, and is proportional to the force of the blow. The initial blow is usually fore and aft resulting in either an open or closed injury.

The ribs are fractured on one or both sides, usually near the angles. Sometimes they are doubly fractured, or the fracture may be comminuted. Multiple fractures produce flail chest. Alternatively the sternum is transected and the costal cartilages dislocated.

The lungs may be severely contused and alveoli filled with blood. They may also be lacerated, with leak of air leading to pneumothorax and surgical emphysema. In one patient, playing football, his left lung ruptured without radiographic evidence of fracture of the ribs after a severe kick on the chest wall.

The diaphragm, oesophagus and aorta, may all be ruptured. The aortic lesion can be latent and declare itself as an aneurysm some weeks after injury. The diaphragmatic lesion may be missed at first, on subsequent X-ray films misinterpreted as "raised diaphragm," and only later found to be traumatic diaphragmatic hernia. The oesophageal lesion is usually first detected at autopsy. There may also be associated injuries of abdomen, spine, spinal cord, head and limbs.

This variety ensures that the patient is usually and understandably admitted under the care of a general surgeon. Whilst the patient must be treated as a whole, the rapidity with which asphyxia kills, makes it imperative to give priority to the thoracic lesion. Of all of these, it is the crush injury to the lung that is the most insidious and the most lethal, for the result of severe trauma is both loss of ventilatory lung function from

flail chest, blocked bronchi, and disordered pleural cavity, and also loss of parenchymal lung function from contusion of the lung.

(4) There are four possible clinical groups into which these patients can be divided.

Group 1: Those so severely injured that they never reach hospital.

Group 2: Those with relatively mild injury.

Group 3: Those with severe injury and closed pneumothorax.

Group 4: Those with open pneumothorax.

In all groups complacency is unwarranted. Each demands respect, immediate critical assessment and constant vigilance.

Patients with open pneumothorax are often more satisfactory to treat in that the very urgency of their open pneumothorax demands immediate operative relief.

To decide if the patient with a closed pneumothorax involved in these accidents is mildly or severely injured is the real problem for even the gravely ill may at first sight appear to have recoverable lesions. At times their assessment proves difficult and disappointing.

The following points are of assistance:

(a) History: When a history is obtainable, one can attempt to gauge the severity of the blow and the possible pathological state incurred at the time. With gunshot or stab wounds, reconstruction of the path of the missile gives the best clue to the extent and severity of the injury.

(b) Physical examination: This usually shows flail chest, surgical emphysema, pneumothorax, sometimes tracheal deviation and respiratory difficulty. Of serious significance is the presence of heavily blood-stained sputum.

(c) Chest radiographs: Especially if the patient can be sat up a little, these define the lesion further. Chest radiographs are of little help in assessing the seriousness of the injury and the imminence of death. They must be taken, but taken expeditiously; but they are usually taken with the patient recumbent, they only serve to confirm the presence or absence of rib fractures, pneumothorax or haemothorax and have been known to lead to an attitude of unwarranted complacency. I have not given a lipiodol swallow but, taken before a chest film, this would show the presence of an oesophageal rupture. A Levin tube inserted before radiography will clarify a ruptured diaphragm with gastric herniation.

(d) Continued observation: When carried out with the help of a special nurse recording five minute pulse, respiration and blood pressure readings, this will materially assist recognition of a severe lesion, especially where intra-pleural bleeding or tension pneumothorax are insidiously progressing. Chest radiographs at half-hourly intervals will confirm that the intra-pleural bleeding is continuing, but should never be demanded as first priority when there is tracheal obstruction or tension pneumothorax requiring more urgent attention.

(5) The fifth major point is to emphasize the wide variety of serious lesions that clinically appear trivial and even allow of several hours of life. Needless to say most of these patients are almost always males.

The following cases in autopsy presented conditions which were impossible to have treated without open operation, yet did their clinical condition warrant such action?

(a) Thoracic trauma—emergency treatment—sudden death.

Case report

J.H., a man aged 25 years, lost control of a loaded petrol lorry and charged down a steep Dunedin street at 80 miles per hour. He failed to corner at the bottom, crashed through a factory wall, and was momentarily pinned between the wheel and truck cabin wall. He was immediately admitted to hospital; and, despite his flail chest, was apparently in surprisingly good condition. There were bilateral fractures of the fourth to eighth ribs with some haemo-pneumothorax. He was treated with bilateral water-seal drainage, intercostal injections of long-acting local anaesthesia, and pad and firm elastoplast support to his flail chest. He seemed fairly well until he died suddenly three hours after admission. Autopsy showed the final cause of death was tracheobronchial obstruction from blood. There were bilateral fractures of the fourth to the eighth ribs with contused and lacerated lungs, bilateral haemothorax, rupture of both domes of the diaphragm, the oesophagus, aorta, liver, spleen, left kidney, as well as a mediastinal haematoma and fractured pelvis.

Comment: He had no blood-stained sputum, but then his pain and flail chest would hardly allow of effective coughing. Only immediate sternal splitting thoracotomy, plus laparotomy and tracheotomy could hope to

have saved the day, yet is it asking too much to undertake such a course? Other experience has shown death is certain without it.

(b) Thoracic trauma — resuscitation — thoracotomy — death.

Case report

W.C., aged 43, was admitted as an emergency on 25th March, 1953, having been struck by a railway engine which caught his jigger at the entrance of a tunnel. He had compound fractures of the left tibia and fibula, a simple fracture of the right tibia and fibula, two deep scalp lacerations for dislocations of right acromio-clavicular joint, contusion of the right lung with tension pneumothorax, and surgical emphysema, as well as lacerated right eye and mild concussion.

On admission to the acute surgeon, he received a two pint blood transfusion, and oxygen therapy. His chest was firmly strapped. Because his condition was not satisfactory, he was referred to the Thoracic Department and taken to the operating theatre, where right thoracotomy was performed.

Blood clot was removed from the right pleural cavity, and two rents in the right lung approximately 2" long were sutured, before deterioration of his condition necessitated rapid termination of the operation. At the end of the operation the patient was bronchoscoped. Because of the question of further injuries to the liver and spleen, a small laparotomy was rapidly performed, but no lesions were detected, and the wound was closed. A further bronchoscopy was performed.

The patient continued to cough up large quantities of blood-stained sputum, and died at 11 p.m. the same night, six hours after injury, and twenty minutes after the operation terminated.

Autopsy confirmed the clinical findings and showed death was due to lacerations and contusion of the lungs, with retention of heavily blood-stained sputum. Both lungs were intensely congested and contused and the cut surface was structureless. There was also diffuse subarachnoid haemorrhage.

Comment: The nature of his death was "asphyxia," and due to blood re-accumulating in his bronchial tree after bronchoscopy. In the light of subsequent experience, I feel that his chances of survival, slender though they were, would have been enhanced by tracheotomy.

(c) Thoracic trauma — emergency treatment — death.

Case report

W.M., aged 44 years, was admitted at 2 p.m. on 19th January, 1954. A few minutes before, while repairing the front bumper of a car, he was seriously crushed by a reversing railway bus.

Clinically he was very shocked, in considerable distress, but conscious. He had a flail chest. Radiologically, the right fourth to the twelfth ribs inclusive were fractured in the scapular line, and the sixth to the ninth inclusive in the axillary line. There was a right haemothorax. The left fourth to the twelfth ribs inclusive were fractured in the axillary line above, and scapular line below. The mediastinum was deviated to the left, and there was surgical emphysema.

Preliminary management: Right intercostal water-seal drainage was instituted and pain relieved by paravertebral injection of local anaesthesia. The flail chest was firmly strapped with elastoplast over a cotton-wool pad. He was watched carefully, but ten minutes after preliminary treatment was finished, he suddenly died in asphyxia, one hour and twenty minutes after admission. A provisional cause of death was regrettably issued, with the result that the coroner refused autopsy.

Comment: (1) It is desirable on all occasion to have an autopsy, even if it means withholding a statement on possible causes of death, until the exact effect of the injury is revealed. Only thus can one get necessary knowledge to guide in future management of these difficult cases.

(2) He did not cough up blood, but then could his chest injury have allowed of effective coughing? Faced with such circumstances again, I should improve airway by performing tracheotomy to reduce dead space, and remove blood and bronchial secretions. The operation can be incredibly effective.

(3) Though blood drained from the intercostal tube, it was not excessive in amount, but blood clot is notoriously rapid in blocking such tubes; and the pleural cavity which has a 4-pint capacity could well have been filling with blood. A second X-ray film within half an hour would have shown this and pointed to the urgency of thoracotomy.

(4) These severe injuries would fare better were they admitted direct to an anaesthetic or resuscitation room in the operating theatre block. Being nearer bronchoscopes, tracheotomy and intercostal sets, their chances of survival, when minutes matter, would be enhanced, and tedious delays when thoracotomy becomes necessary, that much reduced.

(d) Thoracic trauma — delayed treatment — death.

Case report

W.K., aged 30 years, fell from his motor cycle on 29th August, 1955. Four hours after, following an ambulance journey of 100 miles, he was admitted to hospital under the care of the acute surgeon.

On examination he was semi-comatose, but communicable and pink in colour, he had shallow, bubbling breathing and a flail chest. There was no tracheal deviation. Chest radiographs showed fractures of the right clavicle at the junction of the middle and outer thirds, and of the right second to the fourth ribs and left second, fifth and sixth ribs. The film however, was taken with the patient recumbent, and the blood in the pleural cavity thus masked his pneumothorax.

His observers during the night believed him to be in fair condition, though by morning he had surgical emphysema, and a respiration rate of 45 per minute. At this stage, when semi-comatose and cyanosed, he was referred for a thoracic opinion.

He was taken at once to the operating theatre for aspiration bronchoscopy, but before it was done, paravertebral injection of the affected intercostal nerves was undertaken in the hope of relieving the discomfort of the bronchoscopy. While this was under way his condition suddenly deteriorated, he was bronchoscoped, and the bronchial tree, full of blood clot, was sucked clear. A right pneumothorax was simultaneously relieved by an intercostal water-seal drain. He did not respond, and further resuscitative measures, including immediate cardiac compression, were of no avail.

Autopsy confirmed the immediate cause of death to be anoxia from contusion of the lungs with bilateral haemothorax and bronchial occlusion.

Comment: (1) The delay in referring him proved his undoing. His flail chest, moist respiration, deepening cyanosis and inability to cough up sputum were clear indications for emergency action. Had he been promptly treated by bronchoscopy enhanced by tracheotomy to secure an adequate airway, intercostal drainage and supporting the chest by pad and elastoplast, the immediate dangerous corner could have been turned to allow of subsequent thoractomy for haemothorax and chest stabilizing procedures.

(2) The final error was to assume that relief of pain took precedence over adequate aeration of the lungs.

(3) Should one advise routine surgical chest stabilizing procedures in such cases? The flail chest of thoracoplasty is routinely made firm by pad and elastoplast support. My own experience in surgically stabilizing a chest wall has been limited to treating compound fractures; but, as these results have been most gratifying, it may well be that more frequent thoractomy is required for such cases.

(e) Injuries occurring at a distance from a special unit.

Case report

R., a male aged 65 years, was tossed by a bull on 4th December, 1955, and admitted to a hospital three hours travelling time from Dunedin. He was shocked and had surgical emphysema and flail chest wall. There was no blood-stained sputum. Chest radiographs showed a right pneumothorax which was temporarily relieved by right water-seal drainage with suction. His chest wall was partially strapped. Pain was relieved by intercostal injection of local anaesthesia.

When seen by me on a visit the next morning, the intercostal tube had blocked and there was also a left pneumothorax. Bilateral intercostal tubes were inserted, suction connected, the chest firmly supported with pad and elastoplast, and the patient bronchoscoped. He appeared clinically and radiologically satisfactory. His condition remained insecure for the next two days, he developed auricular fibrillation and died from terminal pneumonia three days later.

Comment: (1) There is an art in strapping a chest firmly, and the whole aim is to control paradoxical respiration. If this fails then a chest stabilizing procedure is imperative.

(2) If the patient can be made safe he should be transported to a thoracic unit where all the complexities of persistent pneumothorax, retained secretion, ineffective chest stabilization, and blocked tubes and bottles are more familiar and more readily adjusted.

(f) Associated serious lesions.

So often in the past, residents and registrars have been led to regard fractured ribs as minor ailments, that they are apt to ignore the possibility of associated serious lesion. The following case was not referred.

Case report

J.O'D., aged 67 years, was admitted at 4.30 p.m. on 25th August, 1954, to the acute general surgeon. He was in a small car that was hit by a truck.

Examination showed head injuries, fractured ribs and compression fracture of spine. Although there was considerable shock, his condition remained fair and his injuries gave little cause for anxiety until he died suddenly on the following morning, nineteen hours after the accident.

Autopsy showed death to be due to traumatic rupture of the thoracic aorta, at the level of the 5th thoracic vertebra. There was also a transverse fracture of the sternum in its upper third, fractures of first three ribs on the right and first four on the left close to the sternum. The left fifth to the ninth ribs inclusive were fractured 5 cms. from the vertebral joint. Each pleural cavity contained 500 ml. blood.

Comment: Today there is a place for emergency surgery on aortic lesions using hypothermia to reduce spinal cord metabolism during reconstruction.

PLAN FOR MANAGEMENT

With these principles in mind, the following plan is suggested for managing such cases.

(a) *First aid*

The patient is examined and lesions noted.

1. If there is a compound fracture, especially with pneumothorax, cover the wound promptly with a large "shell dressing" and firmly strap it to the chest wall with elastoplast, not with one strip only, but until the wound and dressing are completely covered, and air excluded. When trying to save lives one cannot afford to economize with dressings and rolls of elastoplast.

2. Remembering the possibility of associated lesions, especially spinal injuries, always move the patient carefully.

3. Avoid embarrassing respiration further by giving morphine.

4. If at any distance, ring hospital to warn the casualty officer and the surgeon concerned of the patient's impending arrival.

(b) *On admission to hospital*

1. If respirations are seriously embarrassed, emergency tracheotomy and intercostal drainage may be required in the Casualty Department. Chest radiographs follow and further treatment is carried out. The time to do a tracheotomy is when considering if it should be done.

2. Where there is a compound fracture, the patient should be admitted direct to an anaesthetic or resuscitation room in the operating theatre block. He is then anaesthetized and intubated, the situation is thereby brought under control, and he is then undressed and prepared for operation.

3. Where there is a closed injury and the patient is not in acute respiratory distress, chest radiographs are taken and are used as a guide, but by no means the only guide to his lesion. If at all possible the patient should sit up, if only to 45°, and allow the shadows of haemo- and pneumothorax to separate. As has been seen, radiographs do not answer the most important problem of all — how serious is the lesion?

4. Thereafter, if the patient has bubbling respiration, bronchoscopy and/or tracheotomy is performed. Tension pneumothorax is relieved by intercostal water-seal drainage. Pain is relieved by intercostal nerve block, and the chest wall is supported and transfusion set up.

5. A special nurse and a physiotherapist are essential, and the least labouring of breathing or quickening of pulse must be reported to the surgeon.

As time matters in these problems (for total asphyxia for three minutes is fatal), sterile tracheotomy, intercostal drainage, chest aspirating and bronchoscopy sets must be kept by the patient's bedside. Such sets should also be standard equipment of all Casualty Departments.

(c) *Progress*

Any increase in haemothorax is gauged clinically by increasing pallor, pulse and respiration rates, and radiologically by serial chest films at hourly intervals.

Where bleeding is uncontrollable, or when a large haemothorax cannot be aspirated, a major bronchus or diaphragm ruptured, the lung severely lacerated or other lesions suspected, urgent thoracotomy is indicated.

Having seen the rapid improvement that occurs when thoracotomy is performed for those with compound fractures, as well as the opportunity for suturing the torn lung and evacuating a haemothorax, it may well be that, having clinically and radiologically localized the site of the lesion, thoracotomy should be performed for all serious closed chest injuries. Growing experience backed by autopsy findings supports this view.

In country districts where animal or tractor accidents occur, the injured patient may first be admitted to a small country hospital. If, by the above measures, his condition can be improved and made relatively safe, he should be transported to a thoracic unit. In such a transfer a doctor should accompany him in the ambulance.

(g) Compound fracture of the sternum—recovery.

Case report

On 18th December, 1955, a boy aged 10 years was struck by his father's truck when riding his bicycle up a driveway. There was a sucking pneumothorax with a large wound across the front of the chest. As a first-aid measure this was covered by a "shell dressing" and firmly strapped to the chest. He was transported thirty miles to Dunedin Hospital by ambulance, and the doctor who attended him, wisely rang the hospital to warn the thoracic surgeon of his approach.

On admission he was taken direct to the operating theatre suite where everything was in readiness for thoracotomy. Anaesthesia was induced using oxygen and cyclopropane. A cuffed endotracheal tube was inserted into the trachea and inflated. Thereafter the pneumothorax was under control and the lad safe. His clothes were next removed.

On lifting the pad there was a wound seven inches long and three inches wide across the front of the chest, equally on the right and left of the mid-line. There was a transverse compound dislocation of the sternum at the level of the sternal angle. On the left side the second and third costal cartilages were dislocated from the sternum, and he had a sucking pneumothorax of the left pleural cavity. Bleeding from the left internal mammary artery had caused a large left haemothorax. The right pleural cavity escaped injury.

The wound was painted with antiseptic solution (cetavlon in spirit), towels applied, and left pleural cavity inspected. It contained at least 150 ml. of blood and blood clot. This was removed and an intercostal drainage tube inserted in the fourth left intercostal space and attached to a water-seal bottle. The sternal fragments were drilled and united by three stainless steel sutures, the wires being threaded through a Gilliam needle. After they were tied the sternal fracture appeared firm. The second right costal cartilage and the second and third left costal cartilages were sewn to the sternum by chromic catgut sutures. The pectoral muscle fibres were next reapproximated and the skin closed with interrupted nylon sutures. A firm pad and elastoplast cover was applied to the wound. During the course of the operation he had one pint blood transfusion.

Immediate post-operative X-ray films confirmed that the left pneumothorax had almost completely disappeared. The skull was also X-rayed, but no cranial lesion detected. Two hours later the boy's condition had greatly improved and he was talking and drinking fluids. He returned to school in February, 1956, and remains well.

CONCLUSION

All thoracic trauma is serious, it must be treated with utmost respect, many patients recover, but those admitted after major thoracic trauma still remain a major problem, the more so in that their injuries so effectively destroy the mechanism of respiration. The danger is anoxia, and three minutes of complete anoxia is fatal.

That these patients with major trauma can live several hours after admission to hospital is a challenge, above all because it is often young men, and because death is more often based directly on the effects of asphyxia from disorder of chest function than from associated irrecoverable lesions. Time and timing are the essence of the contract.

CARCINOMA OF THE BREAST IN A MALE
WITH CARCINOMA OF THE PROSTATE

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CARCINOMA of the male breast is an uncommon lesion, and has excited particular interest previously when it has appeared during stilboestrol therapy. The following is an account of a further example of this association.

Case Report

Mr. F.E., an electrician aged 53, was admitted to the Dunedin Hospital on 6th December, 1953, suffering from acute retention of urine. He had had no urinary symptoms until one month prior to admission, when he first noticed delay in initiating micturition, and a poor urinary stream. This was transient, and he was symptom free until the day prior to admission, when retention of urine was present. There was no significant past history.

On examination the abdomen was normal and the bladder empty, following catheterization before admission. Rectal examination revealed a moderate enlargement of both lateral lobes of the prostate. There was a hard irregular area at the upper pole of the right lobe, which suggested malignancy. Closed continuous drainage of the bladder was instituted.

Three days later his prostate was resected transurethrally. The gland showed moderate intraurethral enlargement of the lateral lobes, which appeared to be hyperplastic when cut with the resectoscope. He made an uneventful recovery from the operation and passed urine well after the catheter was removed.

Histological study of the resected prostatic fragments revealed benign hyperplasia only. The serum acid phosphatase was 9.8 units. X-ray showed no sign of secondary deposits in the pelvis, nor in the lumbar and thoracic spines. He was discharged thirteen days after admission and was given stilboestrol, mg. 30 daily for ten days, and mg. 6 daily.

He remained well, and considering the negative histological report stilboestrol was discontinued after a period of three weeks.

Nine months later, in August, 1954, while helping to lift a car engine, he suddenly felt a "thud" in his left hip, associated with severe pain. He was admitted to the Orthopaedic ward where all movements of the affected hip were found to be limited by pain. X-ray showed a pathological fracture through the left acetabulum with appearances in this region suggesting secondary involvement of the bone from prostatic carcinoma. His leg was placed in extension in a Thomas splint. X-rays revealed no other secondary deposits in bones.

Rectal examination revealed a hard enlarged prostate, especially on the right side. His serum acid phosphatase was 99.7 units. He was given stilboestrol, 6 mgs. daily. The fracture healed and he was discharged on crutches six weeks after admission. Regular dosage of stilboestrol was continued.

He then developed severe pain in the spine and pelvis. In March, 1955, X-rays showed secondary deposits in lumbar and lower thoracic vertebrae. X-ray therapy was instituted in March and April, 1955, with very little relief.

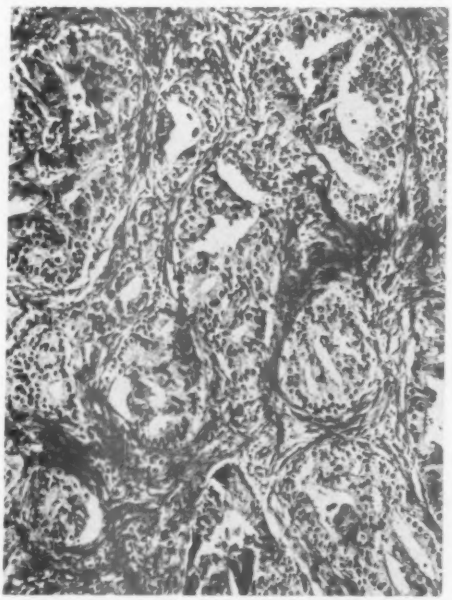

FIG. I. Photomicrograph showing spheroidal cell carcinoma of the prostate. There is some tendency towards glandular differentiation. (x 90)

Re-admission to hospital followed when he complained of severe pain, constipation and difficulty in micturition. On 13th April, 1955, bilateral orchidectomy was performed and he was given cortisone

in an attempt to achieve medical adrenalectomy. His condition continued to deteriorate however, and he died on 18th May, 1955.

Post-mortem examination

This was carried out four hours after death and the relevant findings were as follows:—

There was considerable wasting and cachexia. The cardio-vascular, alimentary and central nervous systems were normal.

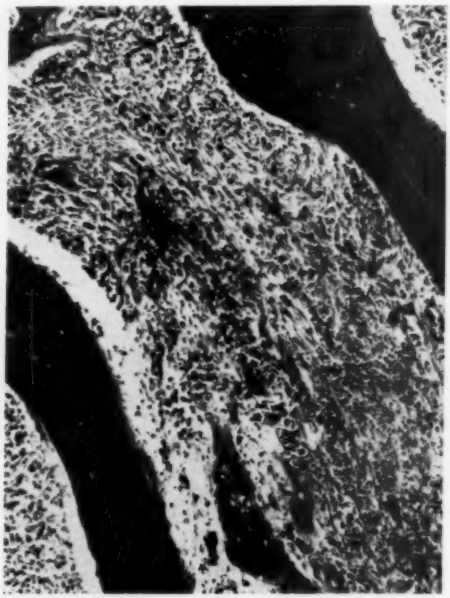

FIG. II. Photomicrograph from section of vertebral body. Diffuse involvement of marrow by poorly differentiated spheroidal cell carcinoma. (x 90)

The prostate was slightly enlarged and nodular and the gland was encapsulated and well demarcated from surrounding tissues. The cut surface showed areas which were firm and homogeneous but the picture was not one of advanced malignancy. Histological study showed a poorly differentiated spheroidal cell carcinoma, the cells tending to be rather uniformly large. The tumour arose from several separate foci and some of the sections examined were relatively uninvolved in the neoplastic process. The capsule was not infiltrated in any of the sections although lymphatics were invaded (Fig. I).

Apart from trabeculation of the bladder, the remainder of the urogenital system was normal.

There were extensive metastatic deposits in the liver, and in the bodies of thoracic and lumbar vertebrae, as well as the bones of the pelvis (Fig. II).

The spleen was soft and congested and Malpigian bodies were somewhat obscured. Histological study showed a diffuse infiltration of the pulp by sheets of large neoplastic spheroidal cells similar in character to those seen in the prostate (Fig. III).

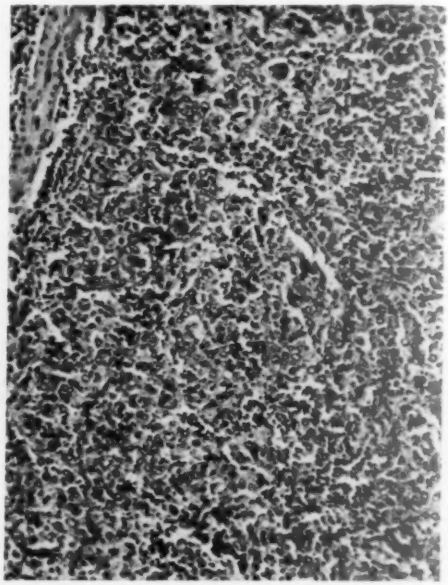

FIG. III. Photomicrograph of section from spleen showing diffuse infiltration of the pulp by neoplastic spheroidal cells. (x 140)

The right breast contained a hard well-defined mass 3.5 cms. in diameter. The cut surface of this was gritty and showed a pale homogeneous appearance. Histologically there was extensive infiltration of the breast tissue by irregular clumps of small neoplastic spheroidal cells. In some areas the appearances indicated new foci of neoplasia originating from recognizable gland fields (Fig. IV).

Both adrenal glands showed microscopic deposits of spheroidal cell carcinoma.

DISCUSSION

The clinical and autopsy findings in this patient support the belief that the malignant condition in the right breast arose after the prostatic carcinoma was well established with bony secondaries. It seems improbable on both histological and clinical grounds that the tumour in the breast was a secondary deposit. Apart from the rather unusual and extensive diffuse involvement of the spleen by metastatic tumour, the interest in this case

lies in the association with stilboestrol therapy.

Hyperplasia of breast tissue has been noted frequently under hormonal influence and gynaecomastia is a well-known side-effect of the treatment (Graves and Harris, 1952). Foote and Stewart (1945) evaluated the structural effects on the breast of stilboestrol therapy. They found both carcinoma and atypical hyperplasia among their cases. Similar studies were made by Moore and Wattenburg (1945) and although malignancy was not observed, atypical hyperplasia was common.

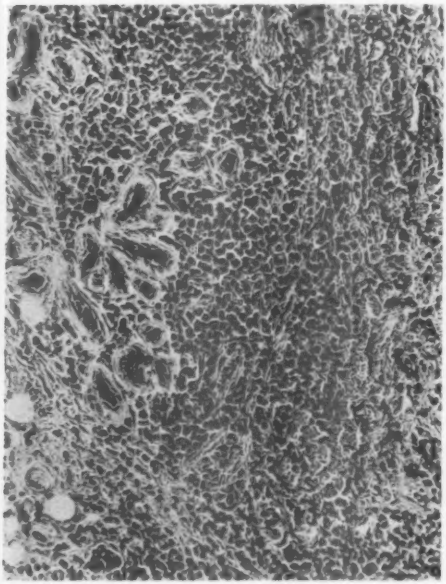

FIG. IV. Photomicrograph of section from breast showing spheroidal cell carcinoma. (x 140)

There are several reports of breast cancer in menopausal females having prolonged oestrogen therapy. The growth was bilateral in the case reported by McClure and Higgins (1951). These authors stress the importance of observing the breasts before and during therapy, with special reference to the family history of cancer. Alleben and Owen (1939), Parsons and McCall (1941), and Huchincloss and Haagensen (1940) have reported similar cases. The latter authors contend that prolonged oestrogen therapy is dangerous from this point of view.

The new growth in the breast was bilateral in the cases cited by Howard and Grosjean (1949), and also those of Corbett and Abrams (1950). In that of the latter treatment had been continued for five years. Abramson and Warshawsky (1948), recommend that the breasts be observed closely during treatment. They also record a case of prostatic malignancy in whom carcinoma of the breast supervened. Treves and Holleb (1955) have reviewed 149 cases of carcinoma of the male breast. It is of interest in view of other reports of single cases similar to ours, that only one case in their series had a growth in the prostate, and he had received no hormone treatment. These workers deduce that the association between hormone therapy and breast cancer can be no more than coincidence.

However, if it is admitted that the aetiology of any form of malignancy may be diverse, complex and variable from one individual to another, it then seems reasonable to believe that the findings in the majority of a large series are not necessarily applicable to a particular case. Many authors have stressed the importance of the administration of large doses of the hormone over prolonged periods as being a necessary factor in the aetiology. The treatment in the present case was intermittent and a total of 2,000 mg. only was given.

We suggest that the reported cases so far and the results of experimental studies warrant a careful observation of the breasts in patients undergoing hormone therapy for carcinoma of the prostate.

SUMMARY

A case of carcinoma of the prostate with widespread metastases is reported in whom a coincident malignant growth was found in the right breast at autopsy. The spleen was diffusely infiltrated with tumour. A possible association with stilboestrol therapy is discussed. Observation of the breasts in patients having this treatment appears warranted.

ACKNOWLEDGEMENTS

We wish to thank Mrs. D. Lemon for the photomicrographs, and the Superintendent of the Dunedin Hospital for permission to use the records of this case.

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Books Reviewed

PRACTICAL UROLOGY.

By ALEX. E. ROCHE, M.A., M.D., M.Ch.(Camb.), F.R.C.S.(Eng.). 1st Edition. London.: H. K. Lewis & Co. Ltd., 1956. 8¾" x 5½", 258 pp., 132 plates. Price: £1 15s. stg.

The author has produced an unusual book composed of a selection of a large number of case reports. These being picked to illustrate rather uncommon conditions or the results of various types of treatment, and particularly cases illustrating most of the post-operative urological complications which urologists generally dread, such as faecal fistula after nephrectomy, slipped renal pedicle, nephrolithotomy in unsuspected polycystic disease, and many other interesting conditions. This book will be found useful in giving the author's experience in such conditions as these, particularly as a guide to treatment should any of these conditions be encountered.

A MANUAL OF PRACTICAL OBSTETRICS.

By the late O'DONEL BROWNE. Revised by J. G. Gallagher. 3rd Edition. Bristol, England: John Wright & Sons Ltd., 1956. 8¾" x 5½", 274 pp., 205 illustrations. Price: 37s. 6d.

This book enters its third edition, the first since the death of its author, Dr. O'Donel Browne. Largely re-written and edited by Dr. J. G. Gallagher it stands as a memorial to the late Master of the Rotunda Hospital, Dublin, and presents the current teaching of the Dublin School of Obstetrics.

It is intended chiefly for the student and general practitioner and being well set out with good line illustrations it will be of genuine assistance to them. Naturally it stresses domiciliary midwifery and many of its recommendations such as repair of perineal lacerations by three silk-worm gut sutures and chloroform as a superior anaesthetic to pudendal block and caudal analgesia are more applicable to the home than to the hospital confinement.

Many people in this country will be surprised to see that the uncomplicated retroverted uterus in pregnancy is replaced and retained in the anteverted position by a pessary. They will not agree that 0.5 millilitre of Pitocin should be administered in the first stage of a breech labour to ensure good contractions. International teaching is not followed in the use of ergot preparations which are not administered late in the second stage of labour for fear of producing uterine spasm and in the treatment of cephalo-pelvic disproportion for which symphysiotomy is advocated.

Because of these variations it is not recommended as a text book for final year students in this country.

THE BRITISH JOURNAL OF TUBERCULOSIS AND DISEASES OF THE CHEST. Golden Jubilee Number, Vol. L, No. 1.

By Sundry Authors. 1st Edition. London: Bailliere, Tindall & Cox Ltd., 1956. 9½" x 7", xxiv plus 103 pp., six plates.

This excellent number fittingly commemorates the Golden Jubilee of a great journal, the first of its kind. The Editorial Board has marked the occasion by the publication of a series of articles contributed by request reviewing the progress and changes in the past 50 years in the management of diseases of the chest, in particular, pulmonary tuberculosis. The result is a superb historical review with the broadest possible outlook, full of the wisdom of many great men in this field. Here the "wood" is never obscured by the "trees."

Epidemiological, social, economic, Public Health and clinical aspects, both medical and surgical, are all presented. Even surgery of the heart and circulation finds its appropriate place. Of particular interest to us in Australia are the articles outlining the development of chest medicine and surgery in the Dominions. Australia's contribution comes from the pen of Dr. Cotter Harvey.

To mention a great name at the head of one of the general articles would require the mention of all, but one cannot fail to refer to the deep wisdom in the epilogue, "Retrospect and Anticipation," by Dr. Maurice Davidson. All physicians and surgeons interested in diseases of the chest will wish to read this number.

ADVANCES IN PAEDIATRICS. Vol. VIII.

By Sundry Authors. Chicago, U.S.A.: The Year Book Publishers Inc., 1956. 5¾" x 8¾", 373 pp., 24 plates, 32 tables. Price: $8.00.

The latest volume, No. VIII in this series, carries on the detailed investigations and intensive search of the literature characteristic of the articles in previous numbers. The section of the aetiology of infant diarrhoea is most extensively done and in the conclusion strikes a note that the empiric treatment of diarrhoea is quite inadequate. In Melbourne we have become used to disappointment with antibiotic therapy and regard fluid and electrolyte therapy as by far the most important part in the management of the really sick case, but the search must, of course, go on both into aetiology and therapy. One hundred and sixteen references accompany this article. There is a very good review based on a specific case of isosexual precocity in boys. Sarcoidosis in childhood is extensively reviewed and it is evident that this still remains something of a mystery. There is an interesting article on the offspring of diabetic and prediabetic mothers which deals extensively with the physical findings in these infants. The important condition of acute subdural effusions is also reviewed with some references to the incidence in meningitis which can alter the smooth course of these conditions with therapy. The anatomic relations of the subdural space which are so often a closed book to students is well described. There is an interesting review of a subject which is coming into great prominence — The Prevention of Accidents in Childhood. The vast importance of this and its recognition at official governmental levels is stressed. Mental deficiency is discussed with one hundred and three references with an extensive section on management of this tragic condition. The short paragraph indicates the complete disappointment obtained in all attempts with organic therapy, e.g. glutamic acid and operations to increase cerebral vascularization.

SIR WILLIAM ARBUTHNOT LANE, Bt.

By T. B. LAYTON, D.S.O., M.S., F.R.C.S. Edinburgh: E. and S. Livingstone Ltd., 1956. 8¾" x 6¼", viii plus 128 pp., portrait and 8 plates. Price: 21s. stg.

Arbuthnot Lane (1856-1943) must always remain an outstanding figure in modern surgery. A highly dextrous technician he is best remembered today for the "no touch" principle which he developed particularly for his orthopaedic operations. This technique, which in his hands gave such remarkable results, was perhaps not sufficiently understood by some who tried to emulate his operations.

His fame rests on the surgical innovations which he introducted and these are notably:—

(i) Rib-resection for empyema in childhood (1883);

(ii) Screwing of fractured long bones to secure perfect apposition (1893); and

(iii) His operation for cleft palate (1897).

His most controversial operation, that of colectomy, was founded on wrong principles and his advocacy of it rather dims his lustre.

Lane lived long enough to see surgery emerge from the pre-Listerian era and to see its amazing development over the last fifty years. It must have given him the greatest satisfaction to watch surgery made safe, particularly as he, himself, had done so much towards making this possible.

T. B. Layton has given us a very graphic account of Lane's life and an excellent insight into his character. He speaks with authority for he knew him and worked with him. He has produced a well-balanced biography which brings out the many aspects of Lane's career, and for this he is to be congratulated.

HISTOLOGICAL APPEARANCES OF TUMOURS.

By R. WINSTON EVANS, T.D., B.Sc., M.R.C.S., L.R.C.P. Edinburgh and London: E. and S. Livingstone Ltd., 1956. 10" x 7½", xvi plus 773 pp., 980 illustrations. Price: 145s. 9d.

This book lives up to its title very well and in its nearly 800 pages has 980 illustrations.

These deserve special mention because they are of a very high order and have clearly been chosen by an experienced pathologist. Characteristic examples and appropriate fields from such, with both low and high power magnification in most cases, provide an excellent presentation of the histological features of most of the tumours.

As stated in the preface, intracranial neoplasms and tumours of the female genital system have not been included. While there may be some doubt as to whether some of the claims in the preface have been fulfilled, there is no question but that this is an excellent general presentation of the subject. At a time when many monographs and text-books are appearing, particularly from America, it is satisfactory to see, in this field, a work of this standard.

It is not possible in the space of even the modern large text-books, to include all the appropriate or even relevant information and this book may not be of great value to the pathologist but to the surgeon and particularly to the younger surgeon who is still interested in his pathological anatomy or, indeed, may still be personally interested in examinations, this is an excellent text-book and reference work. In addition to the excellent illustrations, the statements about each tumour are concise and comprehensive and although in some places where information is still inadequate the opinions expressed will not appeal to everyone, in most cases alternative views are stated.

At the end of each chapter there is a good list of references though these are necessarily incomplete. It would have been possible to give a completely different list but those presented constitute a reasonable coverage of the subject. There is a good index.

Altogether, this is a book which can be strongly recommended to the young surgeon interested in the pathology of tumours.

CARDIOVASCULAR INNERVATION.

By G. A. G. MITCHELL, O.B.E., T.D., M.B., Ch.M., D.Sc. Edinburgh: E. & S. Livingstone Ltd, 1956. 9¼" x 7", xii plus 356 pp., 217 illustrations. Price: 55s. stg.

The author of this very interestingly presented book warns us that our knowledge of the autonomic nervous system is imperfect and that much of this knowledge has been derived from animal studies far removed from man.

He has preferred wherever possible to make observations on humans or at least on the higher primates.

Mitchell prefers to discuss this system as one with both afferent and efferent components — a view which is reasonable because proper control of visceral and vascular functions would be impossible without both afferent and efferent fibres.

Autonomic representation in the cerebrum is discussed but a warning is given that care should be taken in the interpretation of the results of electrical stimulation.

Several viscera are represented in similar areas and in a rather diffuse way. He mentions particularly the pre-motor, motor, orbital and cingulate regions as areas with autonomic representation. Again the hypothalamus, cerebellum, brain stem and spinal cord are well described and illustrated in this regard.

The innervation of the heart and great vessels is described in great detail with many clear illustrations.

In addition, the innervation of peripheral vessels is well treated — a detailed description rarely to be found in any other publication.

There are 217 illustrations and a large bibliography. I believe that this is a significant contribution, especially so because of the amount of investigation of human material.

It is a welcome addition to the literature and should become a standard text on cardiovascular innervation.

Books Received

HANDBOOK OF POISONS.

By ROBERT H. DREISBACH. First Edition. California, U.S.A.: Lange Medical Publications. 7" x 3¾", 426 pp., numerous figures, tables, diagrams. Price: $3.00.

FELLOWSHIP EXAMINATION PAPERS for the Diplomas of the Royal College of Surgeons.

Edinburgh: E. & S. Livingstone Ltd., 1956. 7¾" x 5", 58 pp. Price: 5s. 6d. stg.